Construction Quality Assurance Project Plan

Pre-Final Design (95% Design)

Remedial Design

Area 9/10

Southeast Rockford Groundwater Contamination Superfund Site

Rockford, Illinois

CERCLIS ID No. ILD981000417

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1.0 INTRODUCTION

This document is the Construction Quality Assurance Project Plan (CQAPP) for the Remedial Design for Source Control for the Area 9/10 portion of the Southeast Rockford Groundwater Contamination Superfund Site (CERCLIS ID No. ILD981000417) located in the City of Rockford, Winnebago County, Illinois.

Hamilton Sundstrand Corporation (HS) entered into an Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) on January 13, 2003 for the completion of a Remedial Design (RD) for source control for Area 9/10. Preparation of the CQAPP was specified as part of the February 27, 2003 Statement of Work (SOW) associated with the RD.

The selected remedy for Area 9/10 Remedial Design consists of air sparging and soil vapor extraction to address impacted groundwater (leachate) at the Hamilton Sundstrand Plant # 1 facility within Area 9/10. The remedy is described in the June 11, 2002 Record of Decision (ROD) for Operable Unit Three (OU-3) Source Control. In addition, soil identified as source material at the Outside Container Storage Area (OSA) will be excavated and disposed offsite along with limited groundwater biological enhancement in this location.

1.1 PURPOSE OF CONSTRUCTION QUALITY ASSURANCE PROJECT PLAN

The purpose of this document is to provide the framework of how the construction performance of the Remedial Design will be evaluated. This CQAPP has been developed for the selected remedy at Area 9/10 of the Southeast Rockford Groundwater Contamination Site (SER). The selected remedy consists of air sparging and soil vapor extraction to address impacted groundwater (leachate) at the Hamilton Sundstrand Plant # 1 facility within Area 9/10. In addition, soil identified as source material at the Outside Container Storage Area (OSA) will be excavated and disposed offsite along with limited groundwater biological enhancement in this location. An engineered barrier will be placed over the OSA upon completion of the excavation activities to the target depth.

A summary of the selected remediation alternatives, air sparging (AS) and soil vapor extraction (SVE), from the ROD is as follows:

Groundwater (leachate) Remedy:

- *Alternative SCL-9/10E: Enhanced Air Sparging, which consisted of installing injection wells along the boundary of the Groundwater Management Zone (GMZ) and source area, was the selected remedy. Enhanced Air Sparging will involve the placement of air injection wells down gradient and in the more highly-contaminated areas. Air will be injected into the contaminated groundwater, causing the contaminants to volatilize into air pockets in the soil above the water table. The air sparging will have to be operated in conjunction with the Soil Vapor Extraction System SCS-9/10C. Vapors will be collected underground prior to their treatment with activated carbon.*

- *The leachate remedy also includes institutional controls on groundwater usage within the GMZ, installation of monitoring wells, and implementation of a groundwater (leachate) monitoring program. Groundwater (leachate) will be monitored at predetermined intervals for 30 years, per Resource Conservation and Recovery Act (RCRA) post-closure groundwater monitoring requirements. Monitoring will typically consist of collecting groundwater and analyzing for volatile organic compounds (VOCs) and, where appropriate, parameters that measure biological activity.*

Soil Remedy:

- *Alternative SCS-9/10C: Soil Vapor Extraction with vapor treatment using activated carbon was the selected remedy for soils at Area 9/10. Under this alternative, contaminated soils will be remediated in situ via a SVE system. The system will consist of installing a series of wells connected by an underground piping system. A blower will provide a source of negative pressure to extract vapors from the subsurface. Extraction wells will be screened in the vadose zone, where they will remove the contaminants from the unsaturated zone, as well as groundwater (leachate) contaminants that might diffuse from the surface of the water table. A pilot program will be conducted prior to the design of the SVE system to determine well spacing and in situ air permeability. Vapors collected from the SVE unit will be treated through the use of granular activated carbon.*

Granular activated carbon can be used to treat vapors at this area because of the lower expected concentrations of contaminants from soils.

1.2 CQAPP IMPLEMENTATION

The CQAPP is the framework for the oversight of the RA construction implementation and adherence to the technical specifications in the Remedial Design. This is done to protect the USEPA from additional cost burdens if the work is not completed in a satisfactory manner, as they are typically responsible for the site costs. Typically under CERCLA the Remedial Action (RA) construction is performed by third party contractors with no direct connection to the facility. This will likely not be the case at Area 9/10. The technical specifications provided are in part to provide the necessary framework and detail for the execution of the RA if the USEPA should need to contract this work directly.

It is anticipated that HS will enter into an agreement vehicle (agreement) with USEPA for the implementation of the RA. Assuming that an agreement for the RA is negotiated, HS will assume the responsibility for the costs associated with the installation of the RA and subsequent operation, maintenance, and monitoring. For the RA construction, HS will likely use local contractors that have been, currently are, and plan to be working for HS in the future and, therefore, have a vested interest in performing the work in a satisfactory manner. Also HS owns the Plant #1 property which is an active manufacturing facility and is responsible for facility maintenance. Therefore, if HS enters into an agreement for the RA and assumes the costs for the implementation of the RA, it is anticipated that the technical specifications will be used predominantly as guidance for the installation. As such there will be flexibility available to HS, its consultants, and contractors to use good field judgment and prudent cost benefit evaluation to determine if strict adherence to every technical specification item is necessary and required. USEPA will be kept informed of changes made from the specifications and involved with substantial implementation decisions.

1.3 SITE BACKGROUND

1.3.1 Site Description

Area 9/10 (Area) is an industrial area located within the City of Rockford, Winnebago County, Illinois. The Area is bound by Eleventh Street on the east, Twenty-Third Avenue on the north, Harrison Avenue on the south, and Sixth Street on the west. Hamilton Sundstrand Corporation was the only potentially responsible party identified by the Illinois Environmental Protection Agency (IEPA) for Area 9/10. The Hamilton Sundstrand (HS) Plant #1 facility (the Site) is located within Area 9/10. The Area 9/10 and HS Site locations are shown on Drawing Y1. The address of the facility is 2421 Eleventh Street. The Site is located in the southeast portion of the City of Rockford, Illinois, in Section 36 of Township 44 north, Range 1 east, of Rockford Township in Winnebago County. The HS Plant # 1 facility within Area 9/10 is a generally rectangular area of approximately 13 acres. The Site is bound on the north by 23rd Avenue and former Mid-States Industrial (2401 Eleventh Street), on the south by the former Nylint/DRB property (2525 Eleventh Street) and the Rockford Products Parking lot, to the west by 9th Street, and on the east by 11th Street.

The SER site consists of three Operable Units, each with a corresponding ROD. Operable Unit One (Drinking Water Operable Unit) provided some area residents with a safe drinking water supply by connecting 283 homes to the city water supply. Operable Unit Two (Groundwater Operable Unit) addressed the area-wide groundwater contamination. An additional 264 homes were connected to the city water supply and a remedial investigation (RI) was conducted to characterize the nature and extent of the groundwater contamination and to provide information on source areas responsible for contamination. This operable unit identified four source areas (Areas 4, 7, 9/10, and 11). Operable Unit Three (Source Control Operable Unit) began as a State lead action to select remedies for each of the source areas. Based on the field investigation activities conducted by the IEPA at each of the areas, cleanup alternatives and selected remedies were presented in the May 2002 Source Control Remedies ROD issued by the USEPA and the IEPA.

The selected source control remedies for Area 9/10 are enhanced air sparging for leachate, soil vapor extraction with treatment of vapors by granular activated carbon for soil, and institutional controls. The term leachate is defined as water that passed through waste and picked up contaminants present in the waste.

1.3.2 HS Plant #1 Facility Constituents of Concern

The HS Plant #1 facility was identified during the RI, performed by CDM for IEPA, and the Pre-Design Investigation (PDI), undertaken by HS, as containing groundwater impacted with VOCs above the Preliminary Remediation Goals (PRGs) identified in the ROD. The compounds detected at concentrations above the PRGs are referred to as constituents of concern (COCs). A network of 28 monitoring wells was established at the facility during the PDI. The monitoring well locations and topography (monitoring well ground surface elevations) are shown on Drawing Y3.

The RI also identified COCs in groundwater with concentrations above PRGs. The PRGs were based on 35 IAC Part 620 Groundwater Quality Class I groundwater, 35 IAC Part 742 Tiered Approach to Corrective Action Objectives (TACO), and USEPA maximum contaminant level (MCL) regulations. The groundwater COCs were identified as 1,1-dichloroethene (1,1-DCE); 1,2-dichloroethane (1,2-DCA); 1,2-dichloroethene (1,2-DCE); ethylbenzene; tetrachloroethene (PCE); 1,1,1-trichloroethane (1,1,1 TCA), 1,1,2-trichloroethane (1,1,2 TCA); trichloroethene (TCE); and vinyl chloride (VC), as agreed upon with USEPA and IEPA. The historical groundwater analytical results from the western portion of the building are shown on Drawing Y4.

The soil COCs for Area 9/10 were identified as: 1,1-DCE; methylene chloride (MC) (possible laboratory artifact); PCE; 1,1,1 TCA; 1,1,2 TCA; and TCE as agreed upon with USEPA and IEPA.

1.3.3 Hydrogeological Setting

The geological profile encountered at the HS Plant #1 Facility generally consists of surface pavement (asphalt, concrete pad, or floor slab) with a gravel fill subbase from ground surface to one to two feet below ground surface (bgs), underlain by silty clay to a depth of four to eight feet bgs, which is underlain by poorly to well graded sand (predominantly fine to medium sand) with some gravelly units to below the maximum depth of the borings at the site (140 feet). The sand and gravel has been reported to extend to a depth of 230 to 250 feet bgs in the vicinity of Area 9/10. This glacial outwash is identified as the Mackinaw Member of the Henry Formation. Bedrock encountered in borings/wells in the area is part of the Ordovician period Ancell Group (sandstone) of the Paleozoic era.

The vadose zone extends within the sand to a depth of approximately 30 feet bgs. Within the vadose zone sand there is a discontinuous one to four feet thick silt layer at approximately 18 to 23 feet bgs which was identified in the OSA. This layer was observed only in a limited area in the northwest portion of the Site. No other substantive or continuous fine grained layers or lenses were documented during the PDI investigation activities. At depth within the aquifer some coarser grained gravelly sand and sandy gravel units were observed.

The uppermost aquifer at the Site is the sand and gravel aquifer. The potentiometric surface level ranges between 30 to 35 feet bgs. This level varies somewhat seasonally and appears to mirror the general rainfall pattern of the area. Over the past several years the water level has typically been approximately 33 feet bgs. The aquifer is greater than 100 feet in thickness at the Site. The groundwater flow is to the west-southwest at a gradient of approximately 0.0008 ft/ft (0.6 ft / 715 ft in March 2006) toward the Rock River. The hydraulic conductivity of the sand aquifer is 1.22 x 10^{-3} cm/sec and the aquifer porosity is assumed to be 0.25 (both from the CDM FFS 2000). Using this data, it is estimated that the average linear velocity (also referred to as groundwater seepage velocity) is likely between 4 and 10 feet per year.

1.3.4 Extent of Soil Impacts

The initial RI activities completed by CDM in Area 9/10 consisted of soil gas samples and limited soil sampling. A more comprehensive Pre-Design Investigation consisting of 38 soil borings across the Site, including adjacent properties and public right of ways, was completed by HS in 2003 and 2004. This effort identified three areas of soils which exceed the PRG (and TACO) remediation objectives (ROs). These areas were the OSA, the loading dock and former container storage area, and the western part of the South Alley. The ROD requires that source material be addressed in the remedial design.

Soil in the OSA may be considered source material. Concentrations of 1,1,1-TCA, 1,1-DCE, PCE, TCE, mercury, cadmium, and lead were detected in samples S1 through S8 above ROs. A number of the constituents were found in only relatively shallow soil (less than 8 feet bgs). PCE and cadmium were the only constituents detected above ROs in deeper soils. These metals are not COCs as defined in the ROD. However, the OSA is also subject to RCRA regulations, and these metals are of concern from this perspective.

In the loading dock and former container storage areas, soil concentrations at four boring locations (S12, S13, S14, and SMW-15) exceeded ROs. The elevated concentrations were all in the shallow soil sample intervals at these locations. There were no RO exceedances in the deeper soil samples analyzed at these locations and the impact is believed to be limited vertically. Impacted soil in the loading dock area will be addressed. The remedial activities will likely consist of limited excavation, pending final delineation. This area is presently covered with asphalt.

There was a soil PCE RO exceedance at the SMW-5 location (5 to 7 feet) southwest of the HS Plant # 1 building. There was, however, no PCE detected in the deep soil sample at this location. This area is not considered source material. This location is, however, adjacent to the treatment zone of the air sparge and soil vapor extraction system in the South Alley.

The VOC impacted soil at the OSA is a 65 foot by 50 foot area of approximately 3,300 square feet. HS plans to address these soils by excavation with offsite soil disposal. The impacted soil is primarily in the soil column from ground surface to six feet in depth. The total estimated in place quantity of impacted soil at the OSA is 550 cubic yards (850 tons). Drawing Y4 illustrates the lateral extent of soil impact above ROs at the OSA. A work plan for the excavation of the source material at the OSA was submitted to USEPA dated April 27, 2005 and was approved with modification on August 15, 2005.

1.4 DOCUMENT OVERVIEW

The purpose of this document is to provide the framework of how the construction performance of the Area 9/10 Remedial Design will be evaluated. The five elements of the plan in this document are as follows:

- Responsibility and Authority of the organizations and personnel involved in the design, permitting, and construction of the selected remedies are discussed in Section 2 of this document;

- CQA Personnel Qualifications including necessary education and training of the CQA officer and CQA Inspectors is discussed in Section 2.0 of this document;

- Inspection Activities consisting of observations and tests used to ensure that the construction and installation of equipment meets or exceeds the design specifications is discussed in Section 3.0 of this document;

- Sampling Strategies which identify the sampling activities to be performed, sample size, sample frequency, test methods to be used, and acceptance or rejection criteria to ensure that construction work meets the design specifications is discussed in Section 4.0 of this document; and

- Section 5.0 of the document outlines the documentation of the construction quality assurance activities and reporting requirements.

2.0 RESPONSIBILITY AND AUTHORITY

The parties discussed in this section are associated with the design, permitting, construction, and quality assurance of the all items associated with the construction component of the Area 9/10 Remedial Design. The definitions, qualifications, and responsibilities of these parties are outlined in the following subsections.

2.1 Principal Organizations

The principal organizations involved with the permitting, designing, constructing, and quality assurance of the selected remedies are as follows:

- USEPA and IEPA – Regulatory and Permitting Agency providing oversight and approval;
- HS (Corporate - Facility Owner) – Contracting and completion of the Remedial Design (RD) and Remedial Action (RA) construction activities;
- HS (Facility – Facility Operator) – RA construction guidance and final approval of work completed;
- SECOR – Remedial Design preparation, contracting of RA construction, and construction quality assurance for design implementation;
- Contractors – Construction of the RA in accordance with the RD Final Design within their area of authority; and
- Vendors – Supply equipment, material, and supplies which meet or exceed the performance of those specified in the RD Final Design.

The principal organizations, project roles, and personnel are shown on Figure 1.

2.2 Project Manager

The SECOR project manager will be the primary contact between the parties for communication progress and resolving significant issues and conflicts should they arise. The project manager will work closely with the Construction Quality Assurance (CQA) Officer to ensure the RA implementation is completed in accordance with the Remedial Design. The SECOR project manager is Mr. David M. Curnock.

2.3 Construction Quality Assurance Officer

The SECOR shall appoint an individual, herein referred to as the CQA Officer who is responsible for the oversight of the RA construction and installation. The CQA Officer shall be the primary contact throughout the RA construction. The CQA Officer will review, provide QA/QC, and approve all design calculations and documents. The CQA Officer will also review, provide QA/QC, and approve all design and specification changes during the construction and installation of the RA. The CQA Officer shall notify the USEPA if project specifications or CQAPP procedures cannot be met and alternatives, which require regulatory interaction, are proposed. The CQA Officer will have a professional engineer's license and will be registered in the State of Illinois. The CQA Officer needs to have substantial experience with environmental remediation system design, installation, operation, and contractor oversight.

SECOR has appointed Mr. John Puckett as the CQA Officer. Mr. Puckett has over 14 years of environmental consulting and design experience, focusing, primarily, on groundwater and soil remediation. His responsibilities have included remediation system design, construction, startup, and operation and maintenance (O&M); environmental sampling; hydraulic conductivity and pump testing; soil vapor extraction, air sparging and dual-phase fluid recovery pilot testing; Title V air emission inventories and permit applications; and air pollution control equipment selection, installation, startup, and testing. The resume for Mr. Puckett is included in Appendix A.

2.4 Construction Quality Assurance Inspector

The CQA Inspectors are the official designated/appointed field representative(s) of the CQA Officer. The CQA Inspectors are responsible for all construction quality assurance activities and the proper resolution, with appropriate communication with the CQA Officer, of all quality assurance issues that arise during construction. The CQA Inspector will serve as the on-site contact person with the regulatory agencies during the absence of the CQA Officer.

The selection of the CQA Inspectors is the direct responsibility of the CQA Officer. Qualifications for this position include familiarity with the following: quality control and assurance programs for environmental projects; general earthwork and/or civil and sanitary construction techniques; applicable regulatory requirements, material submittals, and health and safety procedures as applicable to the activities to be performed.

The specific duties of the CQA Inspectors are as follows:

- Serves as a liaison in the field between the contractor, HS facility operator, regulators, and the CQA Officer to assure that communications are maintained.
- Attends quality assurance related meetings, including pre-construction, daily, weekly, and problem/work deficiency meetings as necessary and previously approved by the CQA Officer.
- Reviews all design drawings and specifications and the revisions thereof issued by the CQA Officer.
- Reviews shop drawings of materials and equipment to be used during construction for conformance to the plans and specifications.
- Performs on-site inspections of the work to assess compliance with project standards and the CQAPP.
- Monitors, logs, and/or documents all construction and installation operations.
- Examines and tests various materials, procedures, and equipment during implementation of the construction activities.
- Monitors the following operations for the RA construction:
    - Material delivery.
    - Unloading and on-site transport and storage.
    - Sampling and conformance testing.
    - Construction activities
    - Condition of the soil components as placed.
    - Sampling and field testing of the finished components.
    - Repairs or replacement if and when necessary.
- Prepares daily field reports summarizing the daily RA construction efforts as specified in Section 2.1 of the CQAPP.

- Documents any on-site activities that could result in damage to any parts of the existing site building or new remediation system and brings this information to the CQA Officer's attention.
- Prepares a weekly summary of the all related quality assurance activities.

Listed below are representative SECOR staff who may be the CQA Inspectors. The inspectors must have a thorough knowledge of the activities that they will oversee. The inspectors will have a minimum of three years of environmental consulting experience and have provided oversight in support of various soil and groundwater site investigation and remediation project activities. Resumes for SECOR representative staff, including Chris Armes, Robert Mesec, Amy Rodebaugh, and Chris Kocka, are included in Appendix A.

2.5 Communications

To guarantee a high degree of quality during construction and assure a final product that meets all project specifications, clear, open channels of communication are essential. This section discusses appropriate lines of communication and describes all necessary meetings.

2.5.1 Pre-Construction Meeting

A pre-construction meeting shall be held at the site prior to the beginning of the RA. The meeting shall be attended by the SECOR Project Manager, CQA Officer, CQA Inspector, Contractors, representatives of the regulatory agencies (USEPA and IEPA), and HS.

Specific topics considered for this meeting include review of the project CQAPP for any problems or additions, review of the methods for documenting and reporting inspection data, review of the methods for distributing and storing documents and reports, review of work area security protocol and health and safety procedures as specified in the site specific health and safety plan (HASP). The pre-construction meeting will also include a site walk-around to verify that the design criteria, plans, and specifications are understood and to review material and equipment storage locations. An agenda with specific topics for the pre-construction meeting shall be developed and distributed by the CQA Officer. The meeting shall be documented by the CQA officer, and minutes shall be transmitted to all parties.

2.5.2 Progress Meetings

Progress meetings shall be held weekly at a time and place to be designated by SECOR and shall be attended by, at a minimum, the CQA Officer, Contractor, and the CQA Inspector. The meeting's purposes are:

1. Review construction and compare progress to schedule.
2. Coordinate work for the upcoming week.
3. Review progress of QA/QC program and identify any areas or conditions requiring reconsideration.
4. Identify any problem areas such as work deficiencies, work conflicts, or situations/conditions materially affecting work.
5. Identify potential modifications to either the construction or QA/QC programs which would improve the final work product.
6. Health and safety procedures/monitoring.

2.5.3 Daily Meetings

If necessary, the Contractor and CQA Inspector shall meet occasionally prior to the start of work, to coordinate the day's activities and review the status of any pending issues. The meeting shall be documented in the CQA Inspector's daily report, and shall generally address the following relative to that day's work:

1. General (all parties):
    a. Overview the previous day's activities, accomplishments, and problems or difficulties.
    b. Solution or remedy of any outstanding problem or difficulties.
    c. Update and amendment of the work schedule.
    d. Coordination of activities.
    e. Review health and safety precautions.

2. Contractor:
    a. Planned work activities and work locations.
    b. Solution or remedy of any outstanding problem or difficulties.
3. CQA Inspector:
    a. Resolution or moderation of problem(s).

2.5.4 Problem or Work Deficiency Meetings

The CQA Officer, with approval of the PM, may at any time convene a special meeting to address a work problem or deficiency. At a minimum, the meeting shall be attended by the Contractor and CQA Inspector. Additionally, the CQA Officer may include any other person or party to the meeting agenda if he/she deems appropriate. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

1. Define and discuss the problem or deficiency.
2. Review alternative solutions.
3. Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Inspector, CQA Officer, or designee, and minutes distributed to all participants.

3.0 INSPECTION ACTIVITIES

This section provides a summary of observations, inspections and tests to be used to monitor the construction and/or installation of the components of the remediation system. Inspection activities will include the Contractor's construction quality control procedures and CQAP personnel quality assurance procedures.

3.1 Quality Control Documentation

The Contractor will be responsible for maintaining QC of the work performed and assuring that work meets the requirements of the contract documents and design specifications. The following is a summary of the QC procedures that must be completed by the Contractor in accordance with specifications for construction of the soil and groundwater remediation system. The QC procedures to be conducted by the Contractor can be divided into the following categories:

1. Work Plans to be submitted prior to the pre-construction conference;
2. Shop drawings, manufacturers' certifications, pre-construction submittals, and samples;
3. Testing (certified and uncertified) of physical attributes of materials, inspection of delivered materials, and proper handling of materials;
4. Surveying elevations to allow placement of various construction components, including as-built surveys; and
5. Maintenance of field logs and preparation of daily and weekly progress reports.

The general activities required of the Contractor are summarized in the following sections.

3.1.1 Work Plans

The Contractor will be required to provide a detailed construction schedule identifying each work task and its expected duration to demonstrate that the Contractor has carefully planned the project and to allow monitoring of progress. The Contractor will also submit a detailed Work Plan that includes the following:

1. Description of staging areas;
2. Mobilization and site preparation activities;
3. Permit requirements;
4. Utility Location;
5. Contingency Plans;
6. Contractor Health and Safety Plan;
7. Construction plans for construction of remediation elements; and
8. Performance testing plan for system components.

The Contractor shall be responsible to obtain all necessary permits for construction of the system and to locate all utilities prior to construction. Any necessary operational permits will be secured by SECOR.

3.1.2 Shop Drawing

The Contractor shall provide shop drawings of equipment and appurtenances to be used for the remediation components (e.g., rebar and cut sheets, etc.) as required by the CQA Officer. The Contractor shall obtain written approval of shop drawings by the CQA Officer prior to implementing each design component. All shop drawings will be at minimum distributed to the CQA Officer and CQA Inspector for review. One copy of the shop drawings provided by the Contractor will remain on site, and a second copy will be maintained in the project file at the SECOR Chicago office. Upon the completion of the project, as-built drawings will be generated. Copies of the as-built drawings will be distributed to all parties. Shop drawings may be required for (but not limited to): Concrete, Electrical, Data Communications, Process Piping, and Primary Control Devices.

3.1.3 Testing

The Contractor will test for conformance and ensure workmanship is in compliance with the Contract Documents and design plans and specifications. Testing will include, but not be limited to, concrete, backfill soil, electrical and mechanical equipment. The design plans and technical specifications will provide specific details concerning the frequency and types of tests and performance requirements. The Contractor is required to inspect all delivered materials for conformance with specifications and to handle the material properly to avoid damage.

Contractor testing may include (but is not limited to): concrete; permeability, density, and moisture content tests on the excavation and fill material; top soil grain size distribution; and soil nutrients.

3.1.4 Surveying

The Contractor will survey the location and elevation of the wells, engineered barriers, structures and other appurtenances (as determined by the Engineer). The survey data will be supplied in the Illinois State Plane coordinate system. The Contractor will also be required to assist the CQA Officer in the preparation of as-built drawings showing the final locations and elevations of these items.

3.1.5 Records

The Contractor will be required to keep a daily record of field activities that describes activities conducted, locations and elevations, amount of material moved or placed, problems and resolutions, etc.

3.2 Construction Observation and Documentation

The CQA Inspector shall periodically observe and document the procedures used by the Contractor during system installation and associated site restoration to ensure that all work is performed in accordance with the approved plans, specifications, and the CQAPP. A copy of the Daily Field Observation and Documentation Form is provided in Appendix B.

3.3 Construction Sampling and Testing

This section provides the sampling and inspection requirements to ensure remedial construction activities are in compliance with the contract documents and design plans and specifications. The CQA Officer will be responsible to implement and coordinate confirmation sampling with the

Contractor as necessary. Construction procedures of individual components of the project are presented in the Technical Specifications.

3.4 Field Testing

All exposed fittings and pipe shall be examined by the Contractor and CQA Inspector for leaks and other defects after installation is complete. All quality assurance testing shall be conducted in accordance with the project specifications, or as directed by the CQA Inspector and CQA Officer. At minimum the following shall be completed:

- Piping shall be designed and installed to allow for testing of new pipe sections connected to existing piping or piping installed by others. Use flanges, blinds, etc., as needed.
- Contractor shall perform pressure testing of all pipe sections and fittings while piping is exposed, test prior to cover and backfill. The test method is to be approved by the Engineer and piping manufacturer. Prior to final acceptance of the piping system by the Engineer, the Contractor shall perform hydrostatic testing of the piping system. Contractor shall provide Engineer twenty-four (24) hours notice to witness piping test prior to completion of test and backfill.
- Test pipe in accordance with piping manufacturer's recommendations. Contractor shall provide all material, equipment, and labor for testing of piping systems. At a minimum, pipe will be hydrostatically tested as follows:
  - Fill pipe with water for two to three hours at 150 percent of rated working pressure.
  - Relieve pressure after two to three hour period and then bring pressure back up to 150 percent of rated working pressure.
  - Allow hydrostatic test to continue for three to four hours.
  - Confirm pressure loss is within manufacturer's suggested pipe loss factor.
- Test Records: Records shall be made of each piping system installation during the test. Records shall include:
  - Date of test
  - Description and identification and/or location of piping tested
  - Test fluid
  - Test pressure

- Remarks and notes to identify leaks (type and location)
- Repairs made on leaks
- Results of retest
- Certification by Contractor and signed acknowledgement by Engineer

All equipment required to maintain a specific noise threshold shall be evaluated based on the OSHA Technical Manual, Section III, Chapter 5 Noise Measurement. The OSHA noise measuring guidance is provided in Appendix C. If noise is greater than the threshold spelled out in the design criteria, noise abatement options will be evaluated and implemented. Noise abatement options include but are not limited to acoustic shielding of components, installation of vibration dampening materials directly on sound producing components and installing acoustic dampening materials to surrounding components and structures to reduce overall noise in the treatment environment. Through the evaluation, any or all measures will be implemented to design criteria.

3.5 Field Sampling

Analytical samples will be collected and submitted to the laboratory in accordance with the Quality Assurance Project Plan (QAPP). Samples will be compared to the Preliminary Remediation Goals (PRGs) and Tiered Approach to Corrective Action Objectives (TACO) 35 IAC Part 742 criteria.

3.6 Deficiencies and Repairs

The CQA Inspector and CQA Officer shall evaluate the Contractor's completed construction work for compliance with the specifications and CQAPP. If deficiencies are observed, the CQA Inspector and CQA Officer shall determine the nature and extent of the deficiencies and shall notify the Contractor. The Contractor shall remedy all deficiencies to the satisfaction of the CQA Inspector and CQA Officer. All deficiencies and repairs will be documented.

4.0 SAMPLING STRATEGIES

4.1 OSA Excavation Soils

Soil sampling will be performed associated with the excavation activities at the OSA. Eight soil samples will be collected from the base of the excavation and analyzed for VOCs by Method 8260B and TCLP metals by Methods1311/6010B/7040A/7470A.

4.2 Clay Cap and Engineered Barrier Soils

The clay soil that will be used to backfill the excavated area will be from a documented clean source. One soil sample will be collected and analyzed for the target compound list as identified in 35 IAC Part 740 Appendix A from each source location. The fill will be determined to be clean if there are no VOC, SVOC, and PCB parameters detected. The metals analytical results will be compared to the 35 IAC Part 742 for metal concentrations and area background conditions. The laboratory analytical report and a certification of the source of the clay material will be provided by the Contractor.

4.3 OSA Excavation Backfill Soil

The backfill soil will also be analyzed for permeability, moisture content, and particle size distribution. The soils must be clay as defined by the unified soil classification system (USCS) with a permeability of less than 10-6 cm/sec, have sufficient moisture to facilitate compaction (acceptable range 12 to 18%) and be approved by the CQA officer to be deemed acceptable.

5.0 DOCUMENTATION

The documentation of the CQAPP activities will support a judgment of whether construction activities have been carried out in accordance with the approved engineering plans and specifications. The documentation process includes recognition of construction tasks that should be observed and documented; assignment of responsibilities for the observation, testing, and documentation of these tasks, and the completion of the required reports, data sheets, forms, and check lists to provide an accurate record of the work performed during construction. The CQA Inspector shall provide the CQA Officer with completed and signed reports, data sheets, forms and checklists, as described below, to document that all CQAPP requirements have been satisfied.

5.1 Design Report

During the implementation phase of the RD, SECOR conducted a pilot test to confirm the selected remedy in the ROD. This study confirmed the application of an air sparge, soil vapor extraction, and excavation in the Outside Container Storage Area (OSA) as appropriate options. The *Remedial Design for Source Control for the Area 9/10 portion of the Southeast Rockford Groundwater Contamination Superfund Site (CERCLIS ID No. ILD981000417*) provides the technical basis for the design of the AS/SVE remediation system.

5.2 Work Area Security and Protocol

The AS/SVE work area will be located south of the main facility building, within the fenced-in area. A logbook will be kept in the construction office documenting all personnel who enter and leave the work site. All personnel are required to obtain a daily contractor's badge and sign-in when entering the facility and sign-out when departing. The facility and work area are surrounded by a fence with limited access points which are locked and secured at all times except when entering and departing the site. All contractors must clearly identify their company name on both sides of the vehicles. The OSA area will be secured with temporary fencing.

5.3 Daily Observation Reports

The CQA Inspector shall complete a daily report and/or logs on prescribed forms outlining the monitoring activities for that day. The reports will contain, at a minimum, the following information:

1. Date, project name, location, and the number and names of people on-site.
2. Time work starts and ends, in addition to the time of work stoppages related to inclement weather or insufficient equipment or personnel.
3. Data on weather conditions, including temperature, humidity, wind direction and speed, cloud cover, and precipitation.
4. Contractor's work force, equipment, and materials delivered to or removed from the job site.
5. Chronological description of work in progress, including notices to or requests from the Contractor.
6. Results of testing performed on-site by quality assurance personnel.
7. Problem/Deficiency identification and documentation describing corrective actions taken for field problems and non-conformance with this plans.
8. A record of communications with other on-site parties, property owners, regulatory agencies, or consultants regarding the day's construction activities.
9. A record of calibrations or standardizations performed on field testing equipment, including actions related to and results of re-calibrations.

A summary of all supporting data sheets along with final testing results shall be required upon completion of construction. An example Daily Field Observation and Documentation Report is included in Appendix B.

5.4 Weekly Progress Reports

The CQA Inspector shall prepare a weekly progress report, based on the daily observation reports that summarize the progress to date and any problems and/or deficiencies that are encountered during periodic inspections of construction. A copy of the Weekly Progress Report will be sent from the site to the CQA Officer.

5.5 Problem Identification Reports

Any problems or deficiencies that are identified (*e.g.*, when construction material or activity is observed or tested that does not meet the requirements set forth in this plan) will be included in each Weekly Progress Report. The identified problems shall be cross-referenced to the Daily Field Observation and Documentation Reports or any other documentation that contain data or observations leading to the conclusion that a problem or deficiency exists, and shall contain, at a minimum, the following information:

1. A description of the problems or deficiencies, including reference to data or observations related to the determination of the problem or deficiency and the location of the problem or deficiency, including how and when the problem or deficiency was discovered.
2. A recommended corrective action for resolving the problem or deficiency. If the corrective action has already been implemented, then observations and documentation showing that the problem or deficiency was resolved should be included. If the problem or deficiency has not been resolved by the end of the day upon which it was discovered, then the documentation will state that the deficiency was unresolved at the end of the day.
3. The personnel involved with the discovery and corrective actions taken.
4. Approval and/or acceptance of the corrective action from the CQA OFFICER or PM.

The CQA Officer, working with CQA Inspector, shall determine if the problem or deficiency is an indication of a situation that might require changes to the plans and specifications and/or the CQA Plan. If this situation develops, a meeting will be held with the appropriate people on site, including the CQA Officer, to determine if revisions to the plans or specifications and/or this CQA Plan should be executed. All revisions to the plans or specifications and/or CQA Plan must be approved by the CQA Officer.

5.6 Photographic Documentation

Photographs may be taken by the CQA Inspector to document observations, problems, deficiencies, and work in progress during each phase of laterals installation. Photographs will be in color print format and filed in chronological order in a permanent protective file by the CQA Inspector. The following shall be documented in the daily report or a logbook for each photograph:

1. Date and time.
2. Location where photograph was taken,.
3. Directional view (e.g., N, S, E, W, NW, etc.) of photograph.
4. Description of the subject matter.

5.7 Sampling and Testing Reports

Records of all sampling and testing performed during construction activities, shall be collated by the CQA Inspector on prescribed forms. A summary list of test results shall be prepared by the CQA Inspector on an ongoing basis and submitted with the weekly progress reports.

5.8 Weekly Progress Reports

Weekly progress reports shall be prepared by the CQA Inspector and submitted to the CQA Officer. These reports shall include the following information:

1. Overview of the progress to date.
2. Description of any changes made to the plans, drawings, or specifications.
3. Description of any problems or deficiencies in installation at the site, including any actions implemented to remedy those deficiencies.
4. Summary of activities anticipated for the next reporting period.
5. Daily observation reports for the past week (as an attachment).

5.9 Final Inspection

HS will notify USEPA upon completion of all construction and installation items and schedule a final inspection. The final inspection will consist of a walk-through of the entire project site. Upon completion of the final inspection the startup of the system operation will commence.

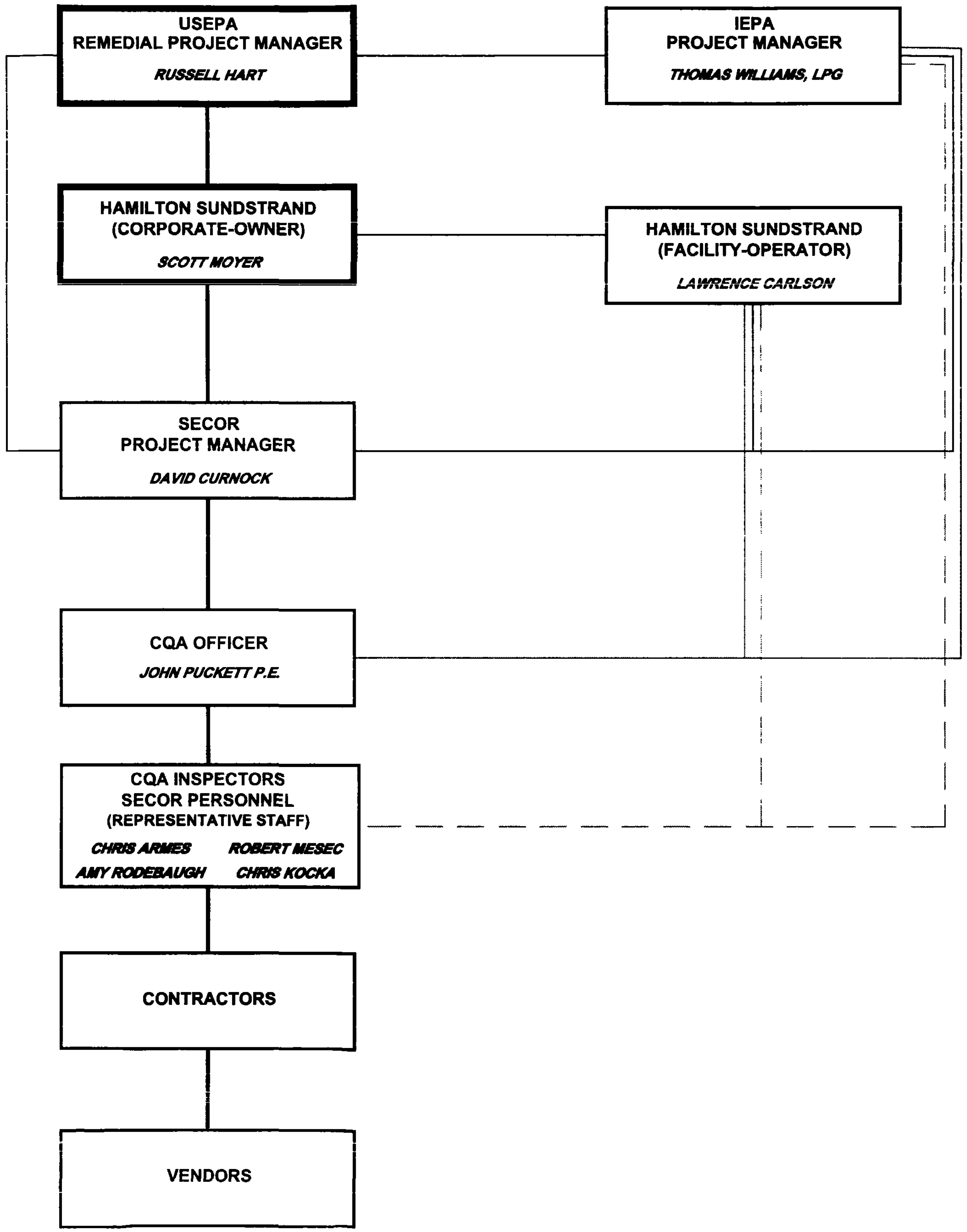
5.10 Construction Report

A Construction Report will be assembled by the CQA Inspector following the completion of all construction activities and following the Final Inspection. The Construction Report shall contain, at a minimum, the following information:

1. Parties and personnel involved with the project.
2. Scope of work.
3. Narrative of the project (detailed chronologically).
4. Quality assurance methods.
5. Record drawings showing the installation of the remediation system
6. A summary of the field observations performed and test results reported.
7. A summary of problems and deficiencies encountered during construction that incorporated engineering design modifications as part of the solution.
8. Substantial deviations from the approved plans and specifications.
9. Photographic documentation of major activities, including construction and installation of the remediation system.
10. Documentation that acceptance criteria were met in accordance with the plans and specifications and the requirements of the CQAPP.
11. Written correspondence with the USEPA and other regulatory agencies.
12. Documentation of final inspection. The final inspection to be attended by the EPA Remedial Project Manager, SECOR project manager, the CQA Officer, and HS.

The SECOR CQA Officer shall certify in the Construction Report that the construction activities were completed in substantial compliance with the applicable design plans and specifications and regulatory approvals and permits. Emphasis shall be placed on any deviations from the approved plans and specifications including the type of substantial deviation and explanation thereof.

FIGURES



ROLE	ACTIONS
PERMITTING AGENCIES	APPROVAL OF SUBMITTED PLANS AND DESIGN, OVERSIGHT OF FIELD ACTIVITIES
OWNER / OPERATOR	OWNER- CONTRACTING FOR WORK EXECUTION OPERATOR- CONTRACTING AND DESIGN INPUT, CONSTRUCTION GUIDANCE, FINAL CONSTRUCTION APPROVAL FOR FACILITY
PRIMARY CONTACT BETWEEN USEPA, HS, AND CQA OFFICER	MANAGE SCHEDULE, BUDGET, DELIVERABLES AND FACILITATE MEETINGS BETWEEN PARTIES AS NECESSARY.
QUALITY ASSURANCE AND QUALITY CONTROL FOR RA PRIMARY INTERFACE WITH PM, HS FACILTY, CQA INSPECTORS, AND CONTRACTORS	REVIEW QA/QC, APPROVAL OF DESIGN AND SPECIFICATION CHANGES DURING CONSTRUCTION AND INSTALLATION OF THE RA. CONFIRM FINAL ACCEPTANCE OF CONTRACTOR WORK PRODUCTS.
FIELD OVERSIGHT OF RA CONSTRUCTION AND INSTALLATION CONTRACTORS	DOCUMENTATION OF CONSTRUCTION AND INSTALLATION IN ACCORDANCE WITH DESIGN AND TECHNICAL SPECIFICATIONS
PERFORMING WORK IN ACCORDANCE WITH DESIGN AND TECHNICAL SPECIFICATIONS	IDENTIFIES DISCREPANCIES ALSO PERFORMS AND DOCUMENTS CONSTRUCTION AND INSTALLATION OF RA.
SUPPLIES MATERIALS AND EQUIPMENT IN ACCORDANCE WITH DESIGN AND TECHNICAL SPECIFICATIONS	

PRE-FINAL DESIGN 95% DESIGN

PREPARED BY:
SECOR
446 EISENHOWER LANE NORTH
LOMBARD, ILLINOIS 60148
PHONE: (630) 792-1680/792-1691 (FAX)

FOR:
AREA 9/10 REMEDIAL DESIGN
SOUTHEAST ROCKFORD GROUNDWATER
CONTAMINATION SUPERFUND SITE
ROCKFORD, ILLINOIS

TITLE:
PRINCIPAL ORGANIZATIONS

DRAWN BY: JC	DESIGNED BY: KTW
CHECKED BY: JGP	APPROVED BY: DMC
PROJECT NUMBER: 13UN.02072.04	SCALE: NOT APPLICABLE
DATE: 1/22/07	FILE PATH: F:\WORK\AUTOCAD\FIGURES\UTC
SHEET: 1	

02072F20.dwg

AREA 9/10 REMEDIAL DESIGN
PRE-FINAL DESIGN
95% DESIGN

SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION SUPERFUND SITE ROCKFORD, ILLINOIS

CERCLIS ID NO. ILD981000417

JANUARY 2007

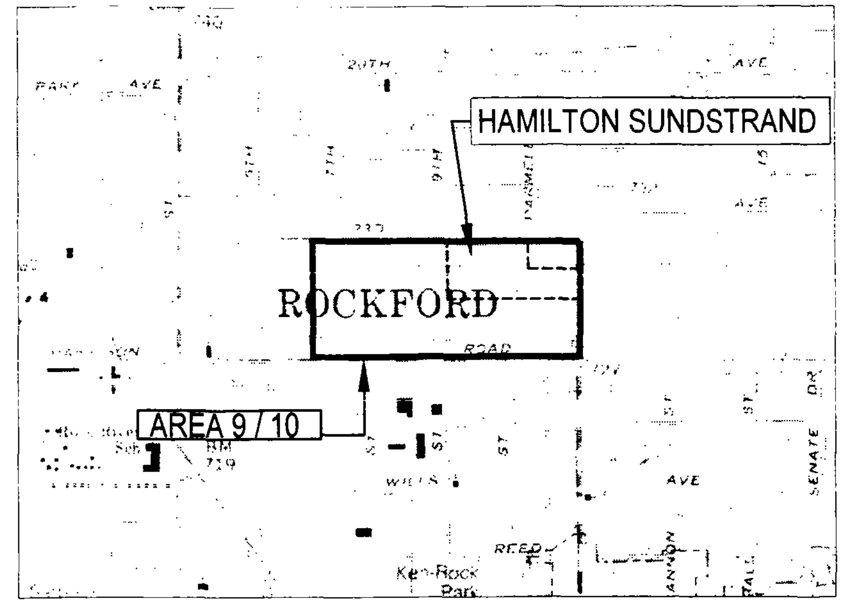
PREPARED BY

SECOR
446 EISENHOWER LANE NORTH
LOMBARD, ILLINOIS
PHONE: (630) 792-1680/792-1691 (FAX)

SECOR PN: 13UN.02072.04.0001

PRE-FINAL DESIGN 95% DESIGN

LOCATION MAP



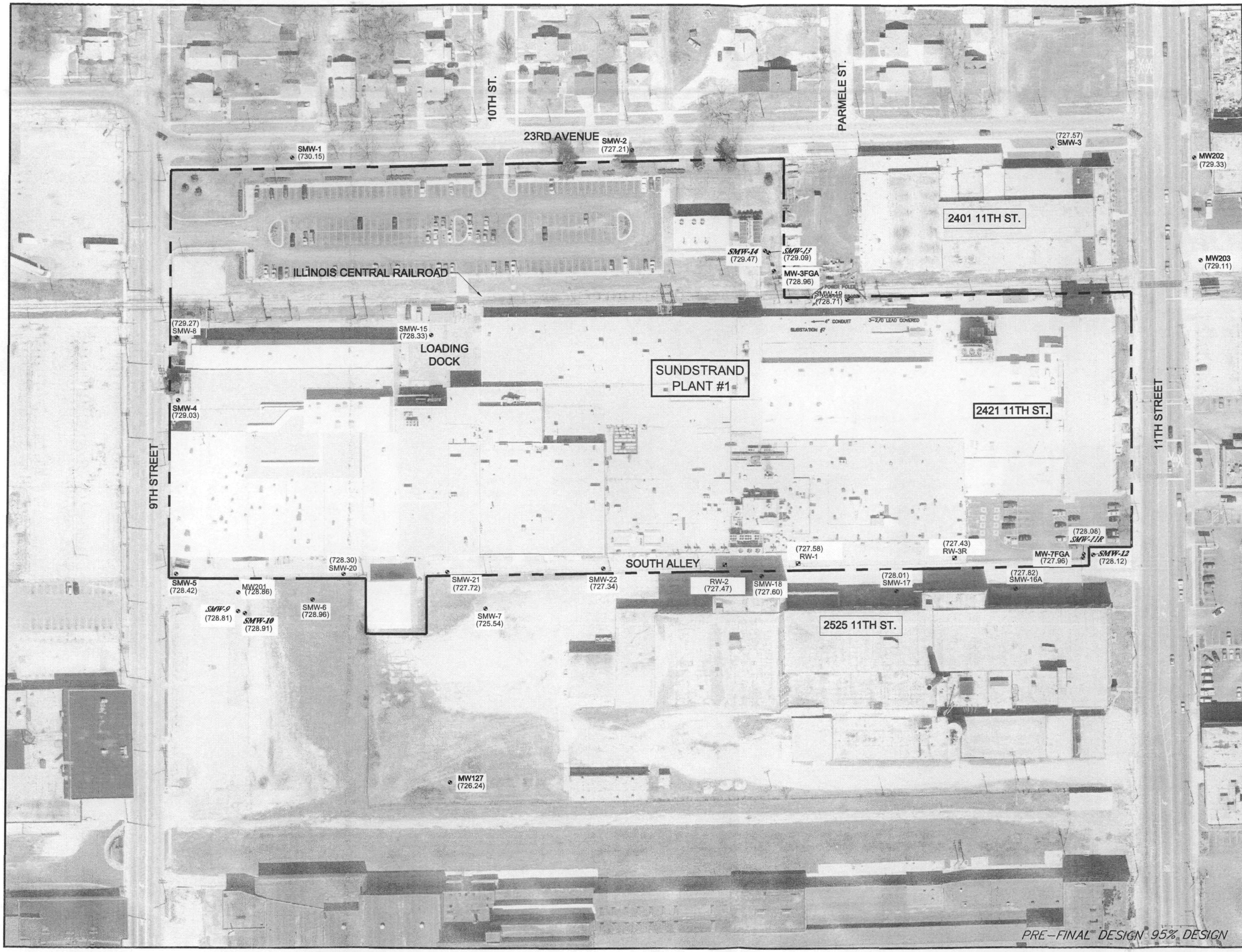
REFERENCE: USGS 7.5 MINUTE QUADRANGLE; ROCKFORD SOUTH, ILLINOIS; 1993

0 1/2 1
APPROXIMATE SCALE (MILES)

DRAWING INDEX

REV	DATE	DESCRIPTION	DSGN	CHCK	APPRV	
A		ISSUED FOR REVIEW				DESIGNED BY: KTW
B		ISSUED FOR REVIEW				CHECKED BY: JGP
0						APPROVED BY: DMC
1						DRAWN BY: JC
						DATE: 1/22/07

FILEPATH: F:\WORK\AUTOCAD\FIGURES\UTC 02072F17.DWG



N

LEGEND:

- PROPERTY BOUNDARY
- MONITORING WELL
- RECOVERY WELL
- (327.72) ELEVATION AT WELL LOCATION

NOTE:

GROUND SURFACE ELEVATION RELATIVE TO MEAN SEA LEVEL. FROM APRIL 2004 SURVEY COMPLETED BY MISSMAN STANLEY AND ASSOCIATES, P.C. OF ROCKFORD, ILLINOIS.

0 120 240

APPROXIMATE SCALE (FEET)

PREPARED BY:

SECOR
446 EISENHOWER LANE NORTH
LOMBARD, ILLINOIS 60148
PHONE: (630) 792-1680/792-1691 (FAX)

FOR:

AREA 9/10 REMEDIAL DESIGN
SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION SUPERFUND SITE
ROCKFORD, ILLINOIS

TITLE:

WELL LOCATIONS AND GROUND SURFACE ELEVATIONS

DRAWN BY: JC	DESIGNED BY: KTW
CHECKED BY: JGP	APPROVED BY: DMC
PROJECT NUMBER: 13UN.02072.04	SCALE: AS SHOWN
DATE: 1/22/07	FILE PATH: F:\WORK\AUTOCAD\FIGURES\UTC
SHEET: Y3	

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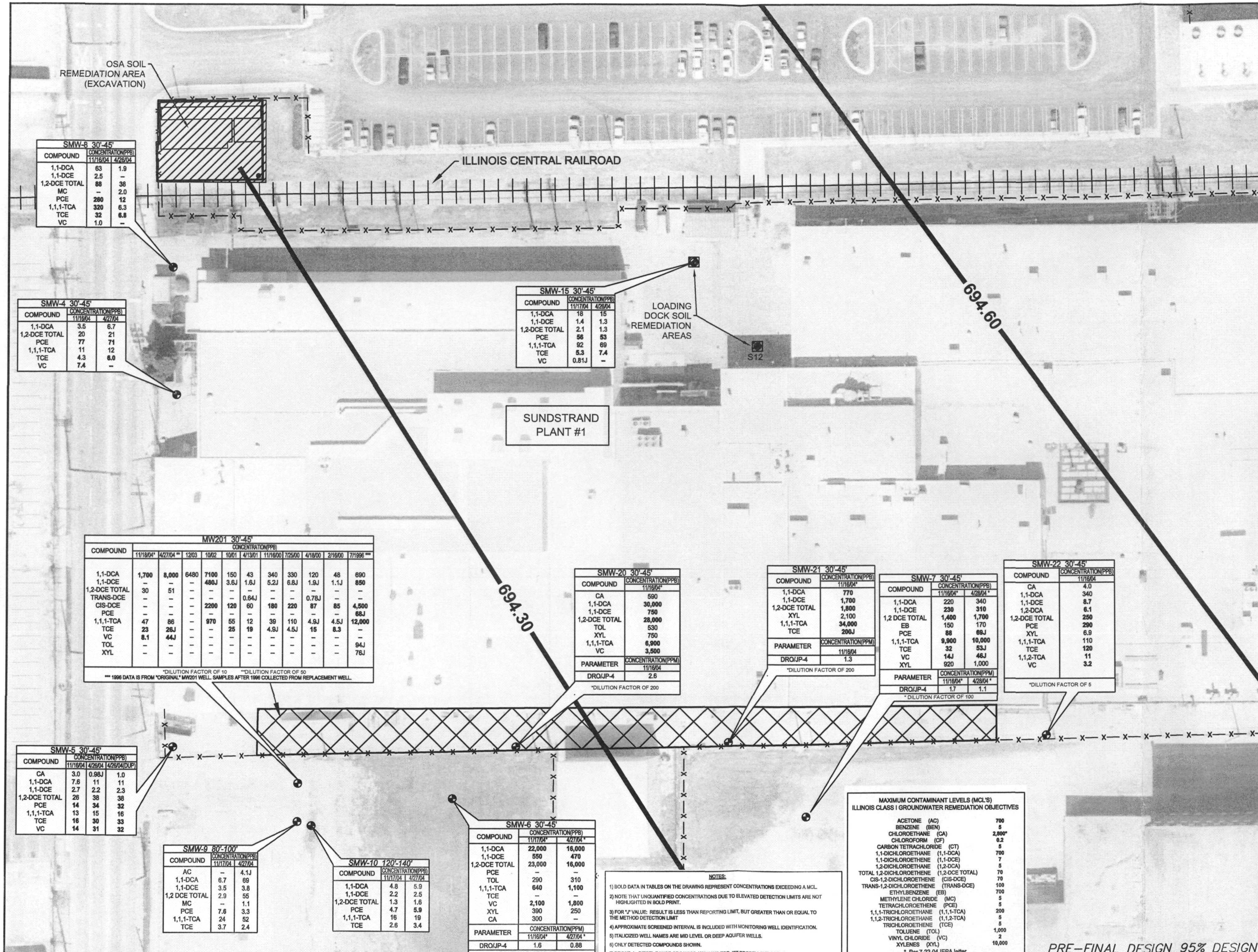

SMW-8 30'-45'		
COMPOUND	CONCENTRATION(PPB)	
	11/16/04	4/26/04
1,1-DCA	63	1.9
1,1-DCE	2.5	–
1,2-DCE TOTAL	**88**	38
MC	–	2.0
PCE	**260**	**12**
1,1,1-TCA	**320**	6.3
TCE	**32**	**6.8**
VC	1.0	–

SMW-4 30'-45'		
COMPOUND	CONCENTRATION(PPB)	
	11/16/04	4/27/04
1,1-DCA	3.5	6.7
1,2-DCE TOTAL	20	21
PCE	**77**	**71**
1,1,1-TCA	11	12
TCE	4.3	**6.0**
VC	**7.4**	–

SMW-15 30'-45'		
COMPOUND	CONCENTRATION(PPB)	
	11/17/04	4/26/04
1,1-DCA	18	15
1,1-DCE	1.4	1.3
1,2-DCE TOTAL	2.1	1.3
PCE	**56**	**53**
1,1,1-TCA	92	69
TCE	**5.3**	**7.4**
VC	0.81J	–

MW201 30'-45'											
COMPOUND	CONCENTRATION(PPB)										
	11/18/04*	4/27/04 **	12/03	10/02	10/01	4/13/01	11/16/00	7/25/00	4/18/00	2/16/00	7/1996 ***
1,1-DCA	**1,700**	**8,000**	6480	**7100**	150	43	340	330	120	48	690
1,1-DCE	–	–	–	**480J**	3.6J	1.6J	5.2J	6.8J	1.9J	1.1J	**850**
1,2-DCE TOTAL	30	51	–	–	–	–	–	–	–	–	–
TRANS-DCE	–	–	–	–	–	0.64J	–	–	0.78J	–	–
CIS-DCE	–	–	–	**2200**	**120**	60	**180**	**220**	**87**	**85**	**4,500**
PCE	–	–	–	–	–	–	–	–	–	–	**68J**
1,1,1-TCA	47	86	–	**970**	55	12	39	110	4.9J	4.5J	**12,000**
TCE	**23**	**26J**	–	–	**25**	**19**	4.9J	4.5J	**15**	**8.3**	–
VC	**8.1**	**44J**	–	–	–	–	–	–	–	–	–
TOL	–	–	–	–	–	–	–	–	–	–	94J
XYL	–	–	–	–	–	–	–	–	–	–	76J

*DILUTION FACTOR OF 10 **DILUTION FACTOR OF 50
*** 1996 DATA IS FROM "ORIGINAL" MW201 WELL. SAMPLES AFTER 1996 COLLECTED FROM REPLACEMENT WELL.

SMW-20 30'-45'	
COMPOUND	CONCENTRATION(PPB)
	11/16/04*
CA	590
1,1-DCA	**30,000**
1,1-DCE	**750**
1,2-DCE TOTAL	**28,000**
TOL	530
XYL	750
1,1,1-TCA	**6,900**
VC	**3,500**
PARAMETER	CONCENTRATION(PPM)
	11/16/04
DRO/JP-4	2.6

*DILUTION FACTOR OF 200

SMW-21 30'-45'	
COMPOUND	CONCENTRATION(PPB)
	11/16/04*
1,1-DCA	**770**
1,1-DCE	**1,700**
1,2-DCE TOTAL	**1,800**
XYL	2,100
1,1,1-TCA	**34,000**
TCE	**200J**
PARAMETER	CONCENTRATION(PPM)
	11/16/04
DRO/JP-4	1.3

*DILUTION FACTOR OF 200

SMW-7 30'-45'		
COMPOUND	CONCENTRATION(PPB)	
	11/16/04*	4/28/04 *
1,1-DCA	220	340
1,1-DCE	**230**	**310**
1,2 DCE TOTAL	**1,400**	**1,700**
EB	150	170
PCE	**88**	**69J**
1,1,1-TCA	**9,900**	**10,000**
TCE	**32**	**53J**
VC	**14J**	**46J**
XYL	920	1,000
PARAMETER	CONCENTRATION(PPM)	
	11/16/04*	4/28/04 *
DRO/JP-4	1.7	1.1

* DILUTION FACTOR OF 100

SMW-22 30'-45'	
COMPOUND	CONCENTRATION(PPB)
	11/16/04
CA	4.0
1,1-DCA	340
1,1-DCE	**8.7**
1,2-DCA	**6.1**
1,2-DCE TOTAL	**250**
PCE	**290**
XYL	6.9
1,1,1-TCA	110
TCE	**120**
1,1,2-TCA	**11**
VC	**3.2**

*DILUTION FACTOR OF 5

SMW-5 30'-45'			
COMPOUND	CONCENTRATION(PPB)		
	11/16/04	4/26/04	4/26/04(DUP)
CA	3.0	0.98J	1.0
1,1-DCA	7.6	11	11
1,1-DCE	2.7	2.2	2.3
1,2-DCE TOTAL	26	38	38
PCE	**14**	**34**	**32**
1,1,1-TCA	13	15	16
TCE	**16**	**30**	**33**
VC	**14**	**31**	**32**

SMW-9 80'-100'		
COMPOUND	CONCENTRATION(PPB)	
	11/17/04	4/27/04
AC	–	4.1J
1,1-DCA	6.7	69
1,1-DCE	3.5	3.8
1,2 DCE TOTAL	2.9	55
MC	–	1.1
PCE	7.6	3.3
1,1,1-TCA	24	52
TCE	3.7	2.4

SMW-10 120'-140'		
COMPOUND	CONCENTRATION(PPB)	
	11/17/04	4/27/04
1,1-DCA	4.8	5.9
1,1-DCE	2.2	2.5
1,2-DCE TOTAL	1.3	1.6
PCE	4.7	**5.9**
1,1,1-TCA	16	19
TCE	2.6	3.4

SMW-6 30'-45'		
COMPOUND	CONCENTRATION(PPB)	
	11/17/04*	4/27/04 *
1,1-DCA	**22,000**	**16,000**
1,1-DCE	**550**	**470**
1,2-DCE TOTAL	**23,000**	**16,000**
PCE	–	–
TOL	290	310
1,1,1-TCA	**640**	**1,100**
TCE	–	–
VC	**2,100**	**1,800**
XYL	390	250
CA	300	–
PARAMETER	CONCENTRATION(PPM)	
	11/16/04*	4/27/04 *
DRO/JP-4	1.6	0.88

* DILUTION FACTOR OF 100

NOTES:

1) BOLD DATA IN TABLES ON THE DRAWING REPRESENT CONCENTRATIONS EXCEEDING A MCL.
2) NOTE THAT UNQUANTIFIED CONCENTRATIONS DUE TO ELEVATED DETECTION LIMITS ARE NOT HIGHLIGHTED IN BOLD PRINT.
3) FOR "J" VALUE: RESULT IS LESS THAN REPORTING LIMIT, BUT GREATER THAN OR EQUAL TO THE METHOD DETECTION LIMIT
4) APPROXIMATE SCREENED INTERVAL IS INCLUDED WITH MONITORING WELL IDENTIFICATION.
5) ITALICIZED WELL NAMES ARE MID LEVEL OR DEEP AQUIFER WELLS.
6) ONLY DETECTED COMPOUNDS SHOWN.
7) DRO/JP-4 - DIESEL RANGE ORGANICS ANALYSIS FOR JET PROPELLANT-4 (JP-4)

MAXIMUM CONTAMINANT LEVELS (MCL'S)
ILLINOIS CLASS I GROUNDWATER REMEDIATION OBJECTIVES

ACETONE (AC)	700
BENZENE (BEN)	5
CHLOROETHANE (CA)	2,800*
CHLOROFORM (CF)	0.2
CARBON TETRACHLORIDE (CT)	5
1,1-DICHLOROETHANE (1,1-DCA)	700
1,1-DICHLOROETHENE (1,1-DCE)	7
1,2-DICHLOROETHANE (1,2-DCA)	5
TOTAL 1,2-DICHLOROETHENE (1,2-DCE TOTAL)	70
CIS-1,2-DICHLOROETHENE (CIS-DCE)	70
TRANS-1,2-DICHLOROETHENE (TRANS-DCE)	100
ETHYLBENZENE (EB)	700
METHYLENE CHLORIDE (MC)	5
TETRACHLOROETHENE (PCE)	5
1,1,1-TRICHLOROETHANE (1,1,1-TCA)	200
1,1,2-TRICHLOROETHANE (1,1,2-TCA)	5
TRICHLOROETHENE (TCE)	5
TOLUENE (TOL)	1,000
VINYL CHLORIDE (VC)	2
XYLENES (XYL)	10,000

* Per 7-22-04 IEPA letter

LEGEND

- MONITORING WELL
- SOIL BORING
- RECOVERY WELL
- FENCE LINE
- GROUNDWATER POTENTIOMETRIC CONTOUR LINE
- SOIL REMEDIATION AREA
- AIR SPARGE AND SVE GROUNDWATER REMEDIATION TREATMENT ZONE

NOTE:
GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS FROM MARCH 23, 2006 IN FEET ABOVE MEAN SEA LEVEL.

0 60 120
APPROXIMATE SCALE (FEET)

PREPARED BY:

SECOR
446 EISENHOWER LANE NORTH
LOMBARD, ILLINOIS 60148
PHONE: (630) 792-1680/792-1691 (FAX)

FOR:

AREA 9/10 REMEDIAL DESIGN
SOUTHEAST ROCKFORD GROUNDWATER
CONTAMINATION SUPERFUND SITE
ROCKFORD, ILLINOIS

TITLE:

GROUNDWATER AND SOIL REMEDIATION AREAS

DRAWN BY: JC	DESIGNED BY: KTW
CHECKED BY: JGP	APPROVED BY: DMC
PROJECT NUMBER: 13UN.02072.04	SCALE: AS SHOWN
DATE: 1/22/07	FILE PATH: F:\WORK\AUTOCAD\FIGURES\UTC
SHEET: Y4	

02072F18.dwg

APPENDICES

SECOR
INTERNATIONAL
INCORPORATED

SECOR

APPENDIX A

SECOR Personnel Resumes

JOHN G. PUCKETT, P.E.
Senior Engineer

B.S. Civil Engineering, 1990, Southern Illinois University, Carbondale, Illinois

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Mr. Puckett has over 13 years of experience in groundwater and soil remediation system design, installation, operation, and maintenance. Technologies include soil vapor extraction (SVE), dual phase extraction, multi-phase extraction, vacuum enhanced product recovery, thermal and catalytic oxidation, air sparging, surfactant flushing, sulfate addition, bio-venting, EFR, in-situ chemical oxidation, and the addition of dissolved oxygen by using iSOC technology.

He has performed various environmental consulting duties for the following industries: Petroleum based fuel production and distribution, processed food manufacturing, aircraft fuel supply and loading, industrial laundry services, rolled steel manufacturing, coal fired power generation, pharmaceutical production, plastic bag manufacturing and printing.

PROJECT EXPERIENCE

- Project manager for remediation system operation and maintenance at a former petroleum terminal facility. The system consists of two pump and treat units averaging 2,200-gpm, five SVE systems, and two bio-venting systems. Duties include system optimization, project reporting, client interface, regulatory agency interface, project budgeting, and project scheduling.
- Providing technical assistance in the form of remediation system design, system installation, system installation oversight, and permitting for several service station sites requiring corrective action.
- Started own consulting business to handle design modifications and maintenance for a wastewater treatment system for phase II of the NuMI construction project.
- Project manager for wastewater treatment system for the NuMI construction project. Designed and supervised installation of an automated chemical feed system to control suspended solids and pH. Trained and managed a team of eight people for system maintenance and monitoring.
- Satellite office manager. Performed office and project management duties for six DNAPL and BTEX remediation projects located in the South Eastern U.S. Duties included maintenance, monitoring, reporting and financials. Trained and supervised a technical team of five. Team responsibilities included system maintenance and sampling.
- Designed and installed soil vapor extraction (SVE) systems for the remediation of chlorinated solvent contamination for numerous industrial laundry facilities.
- Designed and installed air sparging/bio-venting system for a site contaminated with BTEX and fuel oil. The system installation included the design and construction of the system control panel.
- Designed and installed two groundwater remediation systems for DNAPL contamination. The systems utilized packed tower aeration and granular activated carbon adsorption. Performed system layout as well as supervision of installation. Performed system monitoring, maintenance, and repair.
- Designed and installed several pump and treat systems for the remediation of BTEX contaminated groundwater at LUST sites. Treatment system designs included in-situ bioremediation, low profile air strippers and carbon adsorption for the removal of contaminants from extracted groundwater. Designed, built, and installed a pneumatic pumping system for groundwater extraction.

- Evaluated and optimized SVE systems and groundwater extraction systems. Monitored existing systems, evaluated data, determined removal efficiencies and modified systems to increase capture and removal efficiencies.

- Supervised and performed relative accuracy test audits (RATA) on CEM systems installed at coal and/or oil burning power plants. CEM system RATA's consisted of using EPA reference methods 1, 2, 3a, 4, 6c, and 7e. Participated in the certification of over 30 units.

- Supervised and conducted scrubber efficiency tests using EPA reference Method 8 for H_2SO_4 concentration in a metals finishing waste stream.

- Supervised and conducted scrubber efficiency tests using EPA Reference Method 25A for VOC concentration in a waste stream resulting from print shop operations.

- Supervised and conducted a modified EPA Reference Method 18 test on a VOC waste stream emitted from a SVE system.

- Supervised and conducted flow monitor set-ups for CEM systems utilizing USI, Kurz, Panametrics and EMRC flow monitors.

- Conducted diagnostic and compliance gas stream velocity profiles for over 25 units and 10 facilities. Programs included implementation of a variety of measurement devices including 3D and S-type pitot probes. Majority of tests were required to determine or verify acceptability of a CEMS probe and flow sensor site as part of Title 40 CFR 60 and CFR 75.

- Installed, maintained and monitored a CEMS for SO_2, CO, and O_2 emissions from a glass container manufacturing facility.

- Completed Title V air emissions permit applications for five industrial laundry facilities located in Illinois, Ohio, Oregon and Washington.

CERTIFICATIONS

Licensed Professional Engineer (P.E.) State of Illinois 2006
Registered Engineer in Training (EIT) State of Illinois April 1990
OSHA CFR 1910.120 First Responder Certified Trainer
OSHA (40 Hour) #HSR-01194

CHRISTOPHER S. ARMES
Project Geologist

B. S. Geology and Geography, 1996
Northwest Missouri State University, Maryville, MO

Mr. Armes has nine years in the environmental consulting field. He has held the positions of project geologist, project manager, and staff geologist. His seven years of experience includes sampling and remediation at hazardous waste sites, air monitoring, Phase I and Phase II environmental site assessments, underground storage tank (UST) site investigations and remediations, and preparation of investigation and remediation reports to clients and regulatory agencies. Mr. Armes's experience is presented below.

Project Experience

- Project Manager at approximately 45 UST closures and leaking underground storage tank (LUST) sites for a variety of corporate, industrial and individual clients in Wisconsin. Duties included preparation of proposals, conducting subsurface investigations, development, implementation and supervision of remediation activities and preparation of investigation and remediation reports.

- Served as Project Manager for over 30 Phase II environmental site assessments for commercial, industrial, financial, and private clients. Duties included preparation of proposals, supervision of investigation, subcontractor selection, project oversight, budget tracking, client and regulatory agency interface, selection of remedial options, supervision of remediation and long term groundwater monitoring.

- Provided coordination and oversight for a Remedial Investigation/Feasibility Study (RI/FS) at a bulk storage terminal and adjacent properties near Wichita, Kansas. The investigation included the installation of site monitoring wells, and several soil borings along the Little Arkansas River, along with groundwater and soil sample collection. Water samples from private wells were collected from approximately 25 residences for analysis. Also responsible for hydrogeologic interpretation or results and report preparation.

- Responsible for oversight of the operation and maintenance of a groundwater treatment system and monitoring program at a bulk storage terminal in North Little Rock, Arkansas. Responsibilities include scheduling and supervising field personnel and subcontractors, hydrogeologic interpretation, hydrocarbon plume delineation, and preparation of reports

Professional Memberships

National Ground Water Association
Wisconsin Ground Water Association

Professional Certifications and Registrations

Wisconsin Department of Commerce—Environmental Site Assessor Certification No. 245572, 1997
40-Hour OSHA Health and Safety Certification (29 CFR 1910.120), 1996
8-Hour OSHA Health and Safety Annual Certification Update, 1998-2003
Certified Project Geologist, Kansas, 1997
Excavation Safety – OSHA CFR 1926 Subpart P, 2000
Confined Space Safety Training
CPR Certification, 2002

CHRISTOPHER KOCKA
Associate Geologist

B.S Geology, 1996, Southern Illinois University, Carbondale, Illinois

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Mr. Kocka has over 5 years of environmental site investigation and remediation project management experience. He has been primarily involved with Voluntary/Site Remediation Program (SRP) and leaking underground storage tank (LUST) sites in Ohio, Illinois, New Mexico, Wyoming, and Nebraska. Mr. Kocka also has 5 years of oil and gas exploration and development experience within the Illinois Basin.

He has diverse experience including field investigation activities; remediation system installation; remediation system monitoring; institutional control implementation; regulatory reporting; final closure negotiation; financial management; cost tracking, and reserve forecasting. His project experience is presented below.

Aggregate Company – Site Remediation Program

Perform field activities and project review for a former aggregate mine in northern Illinois.

- Review analytical data to ensure compliance within the Illinois Environmental Protection Agency's Site Remediation Program
- Perform site research and assist in report generation.
- Organize field activities with subcontractors and SECOR personnel

Major Oil Companies – Retail Service Station Portfolio

Project manager for approximately 18 service stations in Ohio, Illinois, New Mexico, Wyoming, and Nebraska.

- Project activities included UST removal oversight, initial site investigation, soil contamination and groundwater plume delineation.
- Directed LUST incident reporting including 20 and 45 Day Reports, Site Investigation Reports, Corrective Action Plans, and Corrective Action Completion Reports.
- Provided technical review for environmental reports, regulatory interface, and compliance reporting.
- Maintained site specific information and financial progress using online database systems.
- Implemented alternate technologies (enhanced fluid recovery program, skimmer system, and ORC® injection) to accelerate closure timeline.
- Organized an efficient core project team, specifically trained with client's health and safety program, to address client needs (up to four FTE dedicated staff).

- Evaluated remediation technology alternatives to address soil and groundwater impact at LUST sites and presented recommendations and options to client.

- Managed the operation and maintenance of remediation systems at two sites including groundwater pump and treat, and combined soil vapor extraction (SVE) and pump and treat. Evaluated remediation system data to enhance system efficiency.

- Managed effluent monitoring, National Pollution Discharge Elimination System (NPDES) permit renewal and reporting, and discharge report preparation.

- Conducted soil vapor and indoor air investigation as part of an overall investigation for a LUST site.

- Coordinated waste characterization, profiling, and disposal of soil cuttings and purged groundwater after the completion of field activities.

Paint and Ink Company - Manufacturing Facilities

Field geologist for industrial hygiene monitoring for sites across northern Illinois and northwest Indiana.

- Coordinated and implemented industrial hygiene sampling for workers at facilities in Illinois and Indiana.

- Calibrated field equipment to ensure accurate data collection.

- Performed noise surveys of operating equipment.

Electric Company – Former Manufacturing Gas Plant (MGP)

Performed fence line air monitoring during the excavation of coal tar impacted soil.

- Calibrated and operated dual flame ionization (FID) and photo ionization (PID) equipment to monitor potential air emissions during excavation activities.

- Updated calibration records and field activity event log.

- Collected and analyzed air samples using onsite gas chromatograph for contaminants of concern.

Oil and Gas Exporation Company – Illinois Basin

Coordinated field activities for oil and gas exploration within the Illinois Basin while performing geologic analysis and logging of samples. Managed production and maintenance of approximately 150 oil wells.

- Obtained drilling permits and performed cost analysis of oil wells prior to installation.

- Maintained and operated existing oil wells within the Illinois Department of Natural Resources regulations.

- Prepared and submitted summary reports to state agencies and investors.

- Created and maintained geologic research database for oil and gas exploration.
- Performed exploration of unconventional oil and gas reservoirs.

Professional Certifications and Registrations

8 Hour OSHA Hazardous Waste Refresher Annual Training, 2006
Technical Writing Course, 2006
8 Hour Chevron Health and Safety Training (Loss Prevention System), 2006
Smith Driving System, 2006
Red Cross First Aid, CPR, and AED Training, 2004
40 Hour OSHA Hazardous Waste Training, 1997
American Association of Petroleum Geologist, 1997
Nuclear Safety Training, 1997

ROBERT F. MESEC
Environmental Scientist

B.S. Biology, 1988, Northern Illinois University

Mr. Mesec has thirteen years of professional experience in the environmental consulting field. This experience has included the positions of Project Scientist, Senior Staff Scientist and on-site Field Supervisor. Projects have involved underground storage tank (UST) closures, hazardous waste site remediations, Phase I and II Environmental Site Assessments (ESAs), Storm Water Pollution Prevention Plans (SWPPPs), Spill Prevention Control and Countermeasures (SPCC) Plans, NPDES individual and group permit application preparation, and asbestos inspections and project management. His project experience is presented below.

Project Experience

- Served as on-site Field Supervisor for various UST system closures and hazardous waste site remediations. Included Health and Safety Plan preparation and enforcement, project scheduling activities, subcontractor coordination, client consultation, soil and water sampling, remediation system (air stripping and pump-and-treat) installation, treatment system operation and maintenance (O&M), on-site immunoassay chemical testing, and waste disposal activities coordination. Also prepared reports for ESAs, UST closures, 20-day, 45-day, site classification, and site closure. Performed methods generated by the Tiered Approach to Corrective Action Objectives (TACO).

- Participated in development and implementation of strategies for sites which were involved in the state lead Site Remediation program. Included client meetings, work plan development, implementation of work plans and reporting.

- Participated in several petroleum and volatile organic solvent cleanup projects in Illinois which required the application of Illinois' risk-based cleanup objective guidance and regulations (TACO). Projects involved both soil and groundwater considerations.

- Served under contract to the Illinois Department of Environmental Protection Agency on Leaking Underground Storage Tanks (LUSTs). Provided technical review of remediation plans and site investigations, closure reports review, and media sampling and soil gas screening. Also performed ambient air monitoring, and provided remediation system installation oversight.

- Completed several NPDES general individual and group permit applications. Included performing numerous site investigations related to storm water discharges, training facility personnel in storm water collection in accordance with NPDES protocol, documenting site drainage and facility activities, and preparing SWPPPs for NPDES-permitted facilities.

- Completed several SPCC Plans. Included site inspections and preparing plans in accordance with 40 CFR 112.5(a)-(b).

- Performed Phase I ESAs, including due diligence related to property transactions in accordance with ASTM protocol, assessment activities (visual inspection, potential liabilities for USTs, chemical and drum storage, suspect asbestos-containing building materials [ACBMs]), suspect water/wastewater contamination, hazardous materials/waste storage), and review of registered UST records at the Office of the State Fire Marshall, U.S. EPA CERCLIS listing of Superfund sites, Sanborn Fire Insurance maps, National Wetlands Inventory, and historical aerial photographs.

- Performed Phase II ESAs, including installation of soil borings, monitoring wells, and piezometers; Geoprobe investigations, soil gas, and magnetometer surveys; well elevations surveys; soil, water, sludge, and drum sample collection; monitoring well slug and pump tests; and Zebra mussel and biological sampling.

- Served as Project Manager on numerous asbestos abatement projects for educational, commercial, industrial, healthcare, and government facilities. Responsible for enforcement of contract specifications; daily meetings with contractors; project activities observation; workplace and clearance inspections performance; abatement activities reporting to client; airborne asbestos sample collection to measure worker exposure; airborne fiber concentrations in and near asbestos abatement area(s), and post-abatement sampling to verify "clearance" criteria; air sampling analysis using NIOSH 7400 procedures.

- Served as Building Inspector on numerous Asbestos projects for educational, commercial, industrial, health care, and government facilities.

Professional Certifications and Registrations

AHERA-Accredited Asbestos Building Inspector
AHERA-Accredited Asbestos Contractor/Supervisor, 1997
AHERA- Accredited Asbestos/Air Sampling Professional
Registered Illinois Asbestos Building Inspector, Illinois, 2002
Registered Illinois Asbestos Project Manager, Illinois, 2002
Registered Illinois Air Sampling Professional, Illinois, 2002
Registered Wisconsin Asbestos Building Inspector, Wisconsin, 2002
Industrial Wastewater Treatment Works Operator Certification, Illinois, 1995
NIOSH Sampling and Evaluating Airborne Asbestos Certification, 1989
40-Hour OSHA Health & Safety Certification (29 CFR 1910.120), 1990
8-Hour OSHA Health & Safety Annual Refresher, 2003
8-Hour OSHA Site Supervisor's Certification, 1991
First Aid Certification, 2001
CPR Certification, 2001

Professional Training and Continuing Education Courses

Hydrogeology, Northern Illinois University, 1992
Construction Management and Contracting, Trinton College, 1997

AMY L. RODEBAUGH
Staff Geologist

B S. Geology and Marine Science, 1997, University of Miami, Florida
M.S. Geosciences, 2002, Pennsylvania State University, Pennsylvania

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Ms. Rodebaugh has three years of professional experience in the environmental consulting field. This experience has included both field and office components of projects as staff/project level geologist. Projects have involved Phase I Environmental Site Assessments (ESAs), Phase II ESAs, leaking underground storage tank (LUST) program remediation and reporting responsibilities, performing soil borings, installation and maintenance of remediation systems and monitoring wells, the collection of soil and groundwater samples, oversight of underground storage tank (UST) removal, and oversight of soil excavation and disposal. Her project experience is presented below.

Project Experience

- Supervised various UST removals, monitoring well installation and remediation system installation. Duties included project scheduling activities, subcontractor coordination, client consultation, soil and groundwater sampling, well elevations surveys; free product recovery, soil, water, sludge, and drum sample collection; monitoring well slug tests, and waste disposal activities coordination.

- Performed Phase I ESAs and Phase II ESAs, including due diligence related to property transactions in accordance with ASTM protocol, assessment activities (visual inspection, potential liabilities for USTs, chemical and drum storage, suspect asbestos-containing building materials, suspect water/wastewater contamination, hazardous materials/waste storage), and review of registered UST records at the Office of the State Fire Marshal, U.S. EPA CERCLIS listing of Superfund sites, Sanborn Fire Insurance maps, National Wetlands Inventory, and historical aerial photographs.

- Prepared reports for the IEPA's LUST and site remediation (SRP) programs. LUST reports Include 45-day Reports, Site Classification, Site Investigation, and Corrective Action, plans, budgets, and completion reports. Projects involved the use of the IEPA's Tiered Approach to Corrective Action Objectives (TACO) guidelines for calculating site specific remediation objectives.

- Assisted project completion with gaining right-of-way access agreements, highway authority agreements, bid requests, prepared technical forms, provided QA/QC for historical analytical data.

Professional Certifications and Registrations

40-Hour OSHA Health & Safety Certification (29 CFR 1910.120), 2003
8-Hour OSHA Health & Safety Annual Refresher, 2004, 2006
8-Hour OSHA Supervisor's Certification, 2006
CPR and First Aid Certification, 2005

Publications

Sowers, T.; A Rodebaugh; N. Yoshida; and S. Toyoda. Extending records of the isotopic composition of atmospheric N2O back to 1800 A.D. from air trapped in snow at South Pole and GISP II ice core,
Global Biogeochemical Cycles. Vol. 16 No.4 December 14, 2002

APPENDIX B

Daily Field Observation and Documentation Report Form

SECOR

DAILY FIELD OBSERVATION AND DOCUMENTATION REPORT
Area 9/10 Southeast Rockford Groundwater Contamination Superfund Site
Rockford, Illinois

Report No.

Project No.: 13UN.02072.04	**Day:** ☐S ☐M ☐T ☐W ☐Th ☐F ☐S	**Date:**
Project Name: Area 9/10 Southeast Rockford Groundwater Contamination Superfund Site		
Project Manager:	**Office Contact:**	
Representatives:		
Time Arrived On-Site:	**Time Left Site:**	**Hrs:**
Client Representative(s):		

Status of Project in Relation to Schedule:

Contractors:

Superintendent/Foreman:

Operators/Laborers:

Subcontractors:

Equipment/Materials Delivered:

Weather:			**Temp.:**
Humidity:	**Rain:**	**Pressure:**	**Wind:**

Contractor's Equipment (☒ *Denotes equipment in use today, otherwise idled):*

☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

DAILY FIELD OBSERVATION AND DOCUMENTATION REPORT
Area 9/10 Southeast Rockford Groundwater Contamination Superfund Site
Rockford, Illinois

Report No.

Description of Work in Progress

8:00	
9:00	
10:00	
11:00	
12:00	
13:00	
14:00	
15:00	
16:00	
17:00	
18:00	

DAILY FIELD OBSERVATION AND DOCUMENTATION REPORT
Area 9/10 Southeast Rockford Groundwater Contamination Superfund Site
Rockford, Illinois

Report No.

Quantities of Units Completed (i.e. Waste Placed in Containers for Offsite Disposal)

Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:
Item:	Quantity:

SECOR

DAILY FIELD OBSERVATION AND DOCUMENTATION REPORT
Area 9/10 Southeast Rockford Groundwater Contamination Superfund Site
Rockford, Illinois

Report No.

Testing Performed/Samples Collected:

Field Problems and Nonconforming Materials or Work and Resolutions or Status:

Notices To/From Contractors:

Work Decisions:

DAILY FIELD OBSERVATION AND DOCUMENTATION REPORT
Area 9/10 Southeast Rockford Groundwater Contamination Superfund Site
Rockford, Illinois

Report No.

Daily Communications:

Name/Representing: Time:

Subject/Comments:

Name/Representing: Time:

Subject/Comments:

Name/Representing: Time:

Subject/Comments:

Name/Representing: Time:

Subject/Comments:

APPENDIX C

OSHA Technical Manual Section III Chapter 5 Noise Measurement

Noise, or unwanted sound, is one of the most common health problems in American workplaces. The National Institute for Occupational Safety and Health (NIOSH) estimates that 30 million workers in the U.S. are exposed to hazardous noise. Exposure to high levels of noise may cause hearing loss, create physical and psychological stress, reduce productivity, interfere with communication, and contribute to accidents and injuries by making it difficult to hear warning signals.

OSHA requires employers to determine if workers are exposed to excessive noise in the workplace. If so, the employers must implement feasible engineering or administrative controls to eliminate or reduce hazardous levels of noise. Where controls are not sufficient, employers must implement an effective hearing conservation program.

- **Section I: What is considered "noise" and what are the potential health effects?**
- **Section II: What standards limit and control noise exposure?**
- **Section III: How do I evaluate noise exposure?**
- **Section IV: What constitutes an effective hearing conservation program?**

Section I: What is considered "noise" and what are the potential health effects?

Noise is usually defined as unwanted sound. The following sections provide information related to the origins of noise and its impact on our ability to hear:

- Physics of Sound
- Anatomy and Physiology of the Ear
- Effects of Excessive Exposure
- Ultrasonics

Physics of Sound

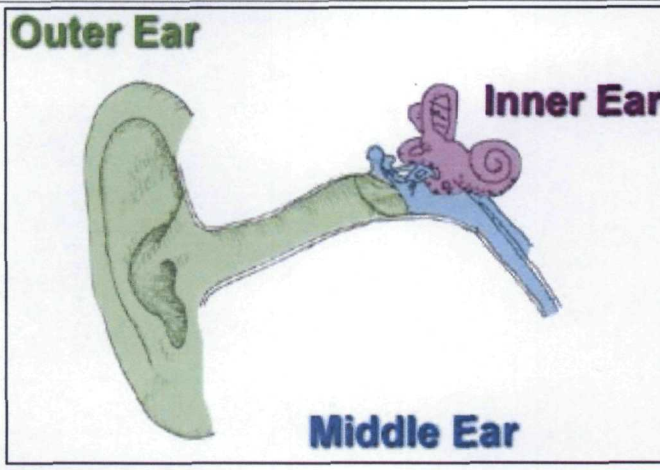
Sound is the physical phenomenon that stimulates our sense of hearing. It is an acoustic wave that results when a vibrating source, such as machinery, disturbs an elastic medium, such as air.

- In air, sound is usually described as variations of pressure above and below atmospheric pressure. These fluctuations, commonly called sound pressure, develop when a vibrating surface forms areas of high and low pressure, which transmit from the source as sound.

Additional information (App I:A) on the physics of sound, including basic qualities, sound fields, sound propagation, filtering, loudness, and sound pressure weighting is also available.

Anatomy and Physiology of the Ear

The ear is the organ that makes hearing possible. It can be divided into three sections:



- External outer ear
- Air-filled middle ear
- Fluid-filled inner ear

The function of the ear is to gather, transmit, and perceive sounds from the environment.

This involves three stages:

1. *Modification* of the acoustic wave by the outer ear, which receives the wave and directs it to the eardrum.
2. *Conversion and amplification* of the modified acoustic wave to a vibration of the eardrum (transmitted through the middle ear to the inner ear).
3. *Transformation* of the mechanical movement of the wave into nerve impulses that will travel to the brain, which then perceives and interprets the impulse as sound.

Additional information (App I:B) on outer ear, middle ear and inner ear is also available.

Effects of Excessive Exposure

Although noise-induced hearing loss is one of the most common occupational illnesses, it is often ignored because there are no visible effects, it usually develops over a long period of time, and, except in very rare cases, there is no pain. What does occur is a progressive loss of communication, socialization, and responsiveness to the environment. In its early stages (when hearing loss is above 2,000 Hertz (Hz)) it affects the ability to understand or discriminate speech. As it progresses to the lower frequencies, it begins to affect the ability to hear sounds in general.

The three main types of hearing loss are conductive (App I:C-1), sensorineural (App I:C-2), or a combination of the two.

The effects of noise can be simplified into three general categories:

- Primary Effects, which includes noise-induced temporary threshold shift, noise-induced permanent threshold shift, acoustic trauma, and tinnitus.
- Effects on Communication and Performance, which may include isolation, annoyance, difficulty concentrating, absenteeism, and accidents.
- Other Effects, which may include stress, muscle tension, ulcers, increased blood pressure, and hypertension.

In some cases, the effects of hearing loss may be classified by cause.

Additional information (App I:C) about the effects of excessive noise exposure is also available.

Ultrasonics

Ultrasound is high-frequency sound that is inaudible, or cannot be heard, by the human ear. However, it may still affect hearing and produce other health effects.

Factors to consider regarding ultrasonics include:

- The upper frequency of audibility of the human ear is approximately 15-20 kilo-Hertz (kHz).
  - This is not a set limit and some individuals may have higher or lower (usually lower) limits.
  - The frequency limit normally declines with age.
- Most of the audible noise associated with ultrasonic sources, such as ultrasonic welders or ultrasonic cleaners, consists of subharmonics of the machine's major ultrasonic frequencies.
  - **Example**: Many ultrasonic welders have a fundamental operating frequency of 20 kHz, a sound that is at the upper frequency of audibility of the human ear. However, a good deal of noise may be present at 10 kHz, the first subharmonic frequency of the 20 kHz operating frequency, and is therefore audible to most persons.

Additional information (App I:D) on ultrasonics and the applicability of OSHA's Occupational Noise Exposure standard, 1910.95, health effects and the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs) is also available.

Section II: What standards limit and control noise exposure?

OSHA has established noise exposure standards in order to protect the hearing of employees. Other federal agencies and organizations have established similar criteria. The following sections provide an overview of these standards:

- General Industry - 1910.95
- Construction Industry
- Other Standards and Guidelines

General Industry - 1910.95

This standard is designed to protect general industry employees, such as those working in the manufacturing, utilities, and service sectors. It does not cover the construction or the oil and gas well drilling and servicing industries.

- 1910.95, Occupational Noise Exposure (See References)

The standard establishes permissible noise exposures and outlines requirements according to two primary sections:

(1) Engineering and Administrative Controls
(2) Hearing Conservation Program

Additional information (App II:A) on the general industry standard is also available.

Construction Industry

OSHA standards for noise in the construction industry:

- 1926.52, Occupational Noise Exposure (See References)
- 1926.101, Hearing Protection (See References)

Permissible Noise Exposures and Engineering and Administrative Controls

- Requirements for permissible noise exposures and controls under the construction standard are the same as those in the general industry standard. [1910.95]

Hearing Conservation Program

- In all cases where the sound levels exceed the values shown in Table D-2, a continuing, effective hearing conservation program shall be administered. [1926.52(d)(1)]
    - There are no specific provisions for the hearing conservation program in construction.

Other Standards and Guidance

The American Conference of Governmental Industrial Hygienists (ACGIH) has established exposure guidelines for occupational exposure to noise in their Threshold Limit Values (TLVs). The following is a summary of these limits:

- Exposures are based on a 3 dBA exchange rate.
- The PEL is 85 dBA. Based on the 3 dBA exchange rate, allowable TLVs for noise range from 80 dBA for a 24-hour period to 139 dBA for 0.11 seconds.
- No exposure to continuous, intermittent, or impact noise in excess of a peak C-weighted sound level of 140 dB is allowed.
- A hearing conservation program is required when workers are exposed to noise above the TLV levels.

The National Institute for Occupational Safety and Health (NIOSH) recommends the following noise exposure criteria (Criteria for a Recommended Standard: Occupational Noise Exposure -- Revised Criteria. NIOSH (1998) Publication No. 98-126):

- An eight hour TWA limit of 85 dBA, with a 3 dBA exchange rate.
- Implementation of a hearing conservation program at an eight hour TWA of 85 dBA.
- Using hearing protection for exposure that equals or exceeds 85 dBA as an eight hour TWA.
- Reduction of expected performance of hearing protectors (25 percent for muffs, 50 percent for formable plugs, and 70 percent for other plugs).

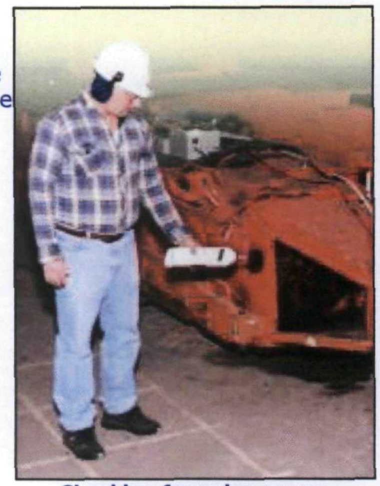
Other Federal Agencies with Noise Standards

The following noise standards are examples only. Refer to the respective agency for complete requirements.

- Department of Defense (DOD)
  - DOD Hearing Conservation Program (HCP). DOD Instruction 6055.12 (1996, April).
- Department of Transportation (DOT)/Federal Motor Carrier Safety Administration
  - Code of Federal Regulations. Vehicle Interior Noise Levels, 49 CFR 393.94.
- Environmental Protection Agency (EPA)
  - Product Noise Labeling. EPA Regulation 40 CFR Part 211 (1979).
- Federal Railroad Administration (FRA)
  - Code of Federal Regulations. Locomotive Cab Noise, 49 CFR 229.121. Also available as a 37 KB PDF, 1 page.
- Mine Safety and Health Administration (MSHA)
  - Health Standards for Occupational Noise Exposure
- U.S. Coast Guard
  - Recommendations on Control of Excessive Noise. Navigation and Vessel Inspection Circular No. 12-82, June 1982. Also available as a 96 KB PDF, 26 pages.

Section III: How do I evaluate noise exposure?

The first step toward solving any noise problem is to define it. To understand what requirements must be implemented according to OSHA's noise standard [1910.95, it is necessary to determine exposure levels. The following sections provide information about evaluating noise exposure levels:


Checking for noise source

- Indications of a Problem
- Walkaround Survey
- Workshift Sampling
- Instruments Used to Conduct a Noise Survey (App III:A)

Indications of a Problem

There are various factors that may indicate noise is a problem in the workplace. While people react differently to noise, subjective responses should not be ignored because they may provide warnings that noise may be at unacceptable levels.

- Noisy conditions can make normal conversation difficult.
  - When noise levels are above 80 decibels (dB), people have to speak very loudly.
  - When noise levels are between 85 and 90 dB, people have to shout.
  - When noise levels are greater than 95 dB, people have to move close together to hear each other at all.
- High noise levels can cause adverse reactions or behaviors. See more information about effects on communication and performance (App I:C).

Walkaround Survey

A walkaround survey should be performed to screen for noise exposures and to determine if additional monitoring is necessary. When screening for noise exposures, sound level meter measurements and estimates of the duration of exposure are sufficient. The resulting spot readings can be used to determine the need for a more complete evaluation. The following general approach may be followed:

1. Tour the facility and develop a detailed understanding of facility operations and potential noise sources. Take the tour with someone who is familiar with plant operations. Speak with knowledgeable personnel about operations and maintenance requirements. Make notes on a diagram of the floor plan if possible. Look for indications that noise may be a problem.
2. Use a sound level meter (App III:A) to take spot readings of operations that are in question. It may be useful to mark the sound levels on a diagram of the floor plan. Make notes regarding what equipment is on or off.
3. Estimate exposures by identifying workers and their locations and estimate the length of time they spend in different areas or how long they operate particular equipment or tools.

If the results of the walkaround survey indicate time-weighted average (TWA) exposures of **80 dBA or more**, then additional noise monitoring should be performed. Remember to take into account the accuracy of the sound level meter when making this estimation. For example, a Type 2 sound level meter has an accuracy of ±2 dBA.

Workshift Sampling

When the results of the walkaround survey indicate that noise levels may exceed those outlined in OSHA's noise standard 1910.95, additional monitoring is necessary.

- Establish a sampling protocol for your workplace. A general protocol (App III:B) is provided as an example.
- In addition to the general information collected during all health inspections, OSHA may collect certain information where it is pertinent to evaluate compliance with OSHA standards (1910.95, 1926.52, or 1926.101). Additional information (App III:C) on inspection data is also available.
- Sample the noise exposures of representative employees from each job classification that may be potentially overexposed.
- Use a dosimeter with a threshold of 80 dBA (A-weighted sound pressure level) and 90 dBA to measure noise exposures. Most modern dosimeters use simultaneous 80 and 90 dBA thresholds and may be used accordingly. Additional information (App III:A) on dosimeters is also available.
    - A dosimeter with a threshold of 80 dBA is used to measure the noise dose of those employees identified during the walkaround survey as having noise exposures that are in compliance with Table G-16 of OSHA's noise standard 1910.95, but whose exposure may exceed the levels specified in Table G-16a [1910.95 Appenix A: Noise Expsoure Computation]. In other words, the 80-dBA threshold is used to determine compliance with the 85 dBA time-weighted average (TWA) action level under OSHA's noise standard.
    - The dosimeter with a threshold of 90 dBA is used to measure the noise dose of those employees identified during the walkaround survey as having potential noise exposures that exceed the sound levels in Table G-16 [1910.95] or Table D-2 [1926.52]. In other words, the 90 dBA threshold is used to determine compliance with the permissible exposure limit (PEL).
- As a minimum, sampling should be conducted for a length of time necessary to establish whether exposures are above the limits permitted by Table G-16, Table G-16a, or Table D-2 (for general industry or construction workplaces, respectively). Instrument accuracy must be taken into account.
- Consider the following with respect to the monitoring results:
    - TWA exposures **at or above the action level of 85 dBA** require a hearing conservation program [1910.95 (c-n)] (results obtained from the 80 dBA threshold).
    - TWA exposures **exceeding the PEL (Table G-16)** require feasible engineering or

administrative controls to be implemented [1910.95(b)] (results obtained from the 90 dBA threshold). Refer to the OSHA Field Inspection Reference Manual (FIRM) for additional information.

- There is also information specific to evaluating noise exposure of employees wearing sound-generating headsets (App III:D).

Section IV: What constitutes an effective hearing conservation program?

An effective hearing conservation program can prevent hearing loss, improve employee morale and a general feeling of well-being, increase quality of production, and reduce the incidence of stress-related disease.

The employer must administer a continuing, effective hearing conservation program whenever employee noise exposures are at or above an eight hour time-weighted average (TWA) of **85 dBA** or, equivalently, a dose of 50 percent. [1910.95(c)(1)] This is referred to as the action level. [1910.95(c)(2)]

Note: The Hearing Conservation Amendment (HCA), as set forth here, does not apply to oil and gas well drilling and servicing operations [1910.95(o)].

Minimum requirements of a hearing conservation program are included in the following sections:

- Monitoring Program
- Audiometric Testing Program (App IV:A)
- Hearing Protection Devices (HPDs)
- Employee Training and Education
- Recordkeeping

There are also specific hearing conservation program requirements for agricultural, maritime, and construction worksites (App IV:B).

Monitoring Program

The employer must develop and implement a monitoring program whenever information indicates that any employee's exposure may equal or exceed the action level. [1910.95(d)(1)]

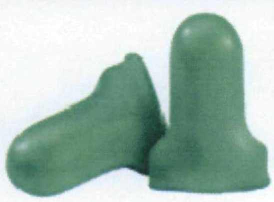
- The sampling strategy must be designed to identify all employees for inclusion in the hearing conservation program, and enable the proper selection of hearing protectors. [1910.95(d)(1)(i)]
- The monitoring requirement is performance-based, as it allows employers to choose a monitoring method that best suits each individual work situation. Either personal or area monitoring may be used.
    - If there are circumstances that may make area monitoring generally inappropriate, such as high worker mobility, significant variations in sound level or a significant component of impulse noise, then the employer must use representative personal sampling unless it can be shown that area sampling produces equivalent results.

[1910.95(d)(1)(ii)]

- Noise measurements must integrate all continuous, intermittent, and impulsive noise levels from 80 to 130 dBA. [1910.95(d)(2)(i)]
- **Repeated Monitoring**. Monitoring must be repeated whenever a change in production, process, equipment or controls increases noise exposures to the extent that [1910.95(d)(3)]:
    - Additional employees may be exposed at or above the action level [1910.95(d)(3)(i)] or
    - The attenuation provided by hearing protectors used by employees may be rendered inadequate to meet the requirements described in Hearing Protection Devices (HPDs). [1910.95(d)(3)(ii)]
- **Employee Notification.** The employer must notify each employee who is exposed at or above the action level of the results of the monitoring. [1910.95(e)]
- **Observation of Monitoring.** The employer must provide affected employees or their representatives with an opportunity to observe noise monitoring procedures. [1910.95(f)]

Refer to the Exposure Evaluation section for additional information on noise monitoring.

Hearing Protection Devices (HPDs)



Hearing protection devices (HPDs) are considered the last option to control exposures to noise. HPDs are generally used during the necessary time it takes to implement engineering or administrative controls, or when such controls are not feasible.

Basic Requirements

- Employers must make HPDs available to all employees exposed at or above the action level. These must be provided at no cost to employees and must be replaced as necessary. [1910.95(i)(1)]
- Employers must ensure that HPDs are worn by employees:
    - where feasible administrative and engineering controls fail to reduce sound levels within those listed in Table G-16. [1910.95(i)(2)(i)] or who are
    - exposed at or above the action level [1910.95(i)(2)(ii)] and who
        - have not yet had a baseline audiogram established [1910.95(i)(2)(ii)(A)] or
        - have experienced a standard threshold shift (STS). [1910.95(i)(2)(ii)(B)]

HPD Selection and Use

- Employees must be given the opportunity to select their HPDs from a suitable variety. [1910.95(i)(3)] Generally, this should include a minimum of two devices, representative of at least two different types.
- The employer must provide training in the use and care of all HPDs provided to employees. [1910.95(i)(4)]
- The employer must ensure proper initial fitting of HPDs and supervise their correct use. [1910.95(i)(5)]

HPD Attenuation

- Attenuation refers to the damping or decrease of noise levels as a result of wearing HPDs.
- The employer must evaluate HPD attenuation for the specific noise environments in which the HPD will be used. [1910.95(j)(1)]
- HPDs must attenuate employee exposure to at least an eight hour time-weighted average of 90 dBA. [1910.95(j)(2)]
    - For employees who have experienced a standard threshold shift (STS), HPDs must attenuate exposure at or below the action level of 85 dBA-TWA (time-weighted

average). [1910.95(j)(3)]

- The adequacy of the HPDs must be re-evaluated whenever employee noise exposures increase to the extent that they may no longer provide adequate attenuation. The employer must provide more effective hearing protectors as necessary. [1910.95(j)(4)]
- Methods for Estimating HPD Attenuation (App IV:C)

Hearing Protection Labeling

- Additional information (App IV:D) on the background of hearing protection labeling, Task Force recommended changes, and other relevant publications are available.

Employee Training and Education

The employer must institute a training program for all employees with noise exposures at or above the action level and ensure employee participation. [1910.95(k)(1)]

- Training must be repeated annually for each employee in the hearing conservation program. [1910.95(k)(2)]
- Information must be updated to be consistent with changes in protective equipment and work processes. [1910.95(k)(2)]

The employer must ensure that each employee is informed of the following:

- The effects of noise on hearing. [1910.95(k)(3)(i)]
- The purpose of hearing protectors, the advantages, disadvantages, and attenuation of various types, and instructions on selection, fitting, use, and care. [1910.95(k)(3)(ii)]
- The purpose of audiometric testing and an explanation of test procedures. [1910.95(k)(3)(iii)]

Access to Information and Training Materials

- The employer must:
  - Make copies of the noise standard available to affected employees or their representatives and post a copy in the workplace. [1910.95(l)(1)]
  - Provide affected employees with any informational materials pertaining to the standard that are supplied to the employer by OSHA. [1910.95(l)(2)]
  - Provide, upon request, all material relating to the employer's training and education program to OSHA. [1910.95(l)(3)]

Recordkeeping

The purpose of OSHA recordkeeping regulations is to assist employers in recognizing and correcting workplace hazards by tracking work-related injuries/illnesses and their causes. Requirements according to the noise standard are:

- **Exposure Measurements**
  - Employers must maintain an accurate record of all employee exposure measurements. [1910.95(m)(1)]
  - These records must be retained for two years. [1910.95(m)(3)(i)]
- **Audiometric Test Records**
  - The employer must retain all employee audiometric test records. [1910.95(m)(2)(i)]
  - These records must include:
    - Name and job classification of the employee. [1910.95(m)(2)(ii)(A)]
    - Date of the audiogram. [1910.95(m)(2)(ii)(B)]
    - The examiner's name. [1910.95(m)(2)(ii)(C)]
    - Date of the last acoustic or exhaustive calibration of the audiometer. [1910.95(m)(2)(ii)(D)]
    - Employee's most recent noise exposure assessment. [1910.95(m)(2)(ii)(E)]
  - The employer must maintain accurate records of the background sound pressure level measurements in audiometric test rooms. [1910.95(m)(2)(ii)(F)]
  - These records must be maintained for the duration of the affected worker's employment. [1910.95(m)(3)(ii)]
- **Access to Records**
  - All records required by the noise standard must be provided upon request to:
    - employees,
    - former employees,
    - representatives designated by the individual employee, and
    - OSHA. [1910.95(m)(4)]
- **Transfer of Records**
  - Employers who cease to do business must transfer to the successor employer all records required by the noise standard.
  - The successor employer must retain these records for the remainder of the periods described previously. [1910.95(m)(5)]

With regard to recordkeeping requirements, OSHA has developed a "decision tree" (7 KB PDF) to determine whether the results of an audiometric exam given on or after January 1, 2003 reveal a recordable STS. See 29 CFR 1904 for additional information on recording and reporting occupational injuries and illness.